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ABSTRACT

Designed to serve as a "how to" guide for policymakers, and state, federal, and institutional leaders, as well as public school and higher education practitioners interested in developing a Tech Prep/Associate Degree (TPAD) consortium, this book provides a detailed synthesis of successful TPAD consortia and programs. The first five chapters offer a rationale, methodology, structure, process, and advice for forming and operating a TPAD consortium. These chapters include: (1) "Every Student a Winner: The Case for TPAD" (D. Parnell); (2) "Getting Off the Ground: The Basics of Developing a TPAD Consortium" (D. Hull); (3) "A Solid Foundation: The Role of Applied Academics" (L. Pedrotti; D. Parks); (4) "It's a Team Effort! Developing and Implementing a TPAD Program" (M. Dutton); and (5) "Smoothing the Rough Spots: Identifying Issues and Overcoming Obstacles" (C. Belcher). Next, chapters 6 and 7 present "Success Stories: Examples of Working TPAD Programs" (D. James; D. Ingram; H. Padden; D.M. Walter; and S. Vigil); and "Retraining for Technology: TRAP for Adults" (W. Edling, A. Sosbe; S. Evertt; and S. Malbrough). Chapters 8 and 9, "Getting 'Em and Keeping 'Em" (J. Marmaras; L. McClure; G. Harpole; and A. Miller); and "The Employer's Role: Connecting Students to the Marketplace" (C. Marsalis; M. Rice), address the issues of recruiting, retaining, and employing TPAD students. Finally, chapter 10, "How Do You Feel about TPAD? (A Forum of Satisfactions and Concerns" (B. Segura; J.F. Yeager; E. Marcom; T. Parker; C. Rouse; C. Phillips; H. Palmer; S. Shields; and E. Henderson), examines the feelings and appraisals of those playing key roles in existing consortia. Appendixes provide curriculum models for TPAD; facts about applied academics; using applied academics to improve general and vocational education in the high school; and references and resources. (MPH)

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TECH PREP ASSOCIATE DEGREE

A Win/Win Experience

DAN HULL
DALE PARNELL

JC910190

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TECH PREP ASSOCIATE DEGREE (TPAD)

has been called the most exciting initiative to hit the educational world in decades. And the reauthorized Carl D. Perkins Vocational and Applied Technology Education Act of 1990 has added major new momentum to this important new program.

This is a how-to-do-it book for anyone involved in Tech Prep/Associate Degree:

- policymakers
- federal leaders
- state educational leadership
- institutional leaders
- administrators
- faculty and counselors

It also provides useful information for employers, parents, students, community and business leaders, and economic development organizations. While the future of the American educational system may be filled with questions and uncertainty, this is a book of **answers** and practical, down-to-earth advice from the visionaries, architects and practitioners of TPAD programs that work. It addresses questions like:

What is a TPAD program? How is it different from 2 + 2 and other forms of articulation? Why do we need TPAD programs? Who (or what) sustains it? How do you organize a TPAD consortium? Who are the key players? What is the process? How do you turn a good 2 + 2 program into a great TPAD program? Why are Applied Academics better for some students? How do they compare with other current courses? What are some of the common issues/obstacles in implementing TPAD, and how can you

(Continued on back flap)

TECH PREP ASSOCIATE DEGREE

A Win/Win Experience

TECH PREP ASSOCIATE DEGREE

A Win/Win Experience

Written and Compiled by

Dan Hull and **Dale Parnell**

CORD

Center for Occupational
Research and Development

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Foreword

American education is under the greatest scrutiny in our history. If reports and studies alone could improve schools and colleges we would have achieved excellence in education a long time ago. What has been lacking in these reports is practical, down-to-earth advice on how to improve student learning for that great group of ordinary students called the neglected majority. Dan Hull and Dale Parnell have combined their efforts in developing a valuable new "how to" book describing the new Tech Prep/Associate Degree program...and how this exciting program can be implemented in our schools and colleges. They point out a basic weakness in our current educational program...the lack of a rigorous, constructive program of study to better prepare that great host of high-school students who will not likely earn a college baccalaureate degree. They make a convincing case for the argument that the complex, technological world of the future has already arrived. Higher and more comprehensive skills must be developed by all students.

It is a privilege to commend the reading of this insightful new book to policymakers at all levels of education, to school and college administrators, and particularly to faculty members. Meeting the educational needs of the neglected majority just may be the greatest single need in America today.

Norma Paulis
Superintendent of
Public Instruction
State of Oregon

Preface and Acknowledgments

In the spring of 1984 we met together, along with Drs. Gene Bottoms and Leno Pedrotti, to plan a national strategy to foster 2+2 articulation programs in technical education throughout the United States. Each of us had already begun thinking independently about this issue and we knew that a few efforts were under way. As a result of this meeting, we personally conducted 2+2 articulation workshops at the national meetings of the American Vocational Association (AVA) in December 1984 and the American Association of Community and Junior Colleges (AACJC) in April 1985.

In the spring of 1985 Dale completed *The Neglected Majority*, which proposed and defined "tech prep" as a viable high-school alternative to the time-honored college-prep program. Dale called for a national movement to establish and develop tech prep as a valid and significant reform for technical education. During the next five years "tech prep" was promoted, discussed, successfully implemented by many educators—and included as a major component of the federal legislation called the Carl D. Perkins Vocational Technical Education Act of 1990.

During that same period, Dan, Leno, Jim Lovett and other CORD staff helped twelve tech-prep consortia in eight states to design and implement Tech Prep/Associate Degree curricula and programs. Many of the ideas, processes, curriculum models, and organizational structures presented in this book were designed and/or discovered in these consortium activities. Also during this period the applied-academics curriculum materials were developed, tested, and disseminated, and Gene Bottoms formed the Southern Regional Education Board consortium to integrate applied academics into high-school vocational programs.

In a twelve-month period, beginning in November 1989, CORD, AACJC, the National Association of State Directors of Vocational Technical Education Consortium (NASDVTEC), the National Center for Research in Vocational Education (NCRVE), the Northwest Regional Educational Laboratory (NWRL), and others cosponsored tech-prep workshops in Portland, Dallas, Cincinnati, Savannah, Hagerstown, and Los Angeles. Over 1600 secondary and postsecondary educators attended the meetings. Many examples of successful TPAD programs and enhancements were showcased in these meetings. From CORD's earlier TPAD facilitation work and from the research and format for the workshops emerged the design, rationale, methodology, and organization for this book. But, to capture the experience, attitudes, issues, ideas, and successes, we have relied on the contributions of the outstanding collaborators whose names and qualifications are briefly noted in the List of Contributors; we are deeply indebted to all of them.

Tech Prep/Associate Degree: A Win-Win Experience is a how-to-do-it book for policymakers, federal leaders, state educational leadership and institutional leaders, administrators, faculty and counselors in public schools and higher education who are interested in, committed to, and/or planning a TPAD consortium in their localities. The book also provides useful information for employers, parents, students, and economic-development organizations.

The first five chapters contain rationale, methodology, structure, process, and advice for forming and operating a TPAD consortium. They should be read straight through before "browsing around" where your interests and intents lead you.

In the next two chapters we look closely at examples of TPAD programs developed across the country by different types of people, in different environments, and for different purposes. Each example should be read as a separate entity, with time to reflect on its unique purpose, organization, strategies, and benefits.

Chapters eight and nine address the issues of recruiting and retaining TPAD students. Chapter eight includes examples of enhancements that can be adapted to increase TPAD acceptance by students, parents, educators, employers, and community leaders. Chapter nine provides advice and examples for significant employer involvement in and support for TPAD programs.

The last chapter of the book deals with the feelings and appraisals of people in a key role who have each experienced a TPAD consortium. If you are a superintendent, college president, teacher, counselor, employer, or administrator, search this chapter to find out how a colleague feels who's "gone through the process."

The book presents a TPAD model in terms of educational philosophy, curricula, strategies, methodology, and anticipated outcomes. Like all models, it probably doesn't fit anywhere in its entirety; but if it is worthy, it should form the basis for many local adaptations. We feel that the structure is a sound one. We believe that with the correct mixture of experience, commitment, sensitivity, creativity, and hard work, your TPAD team can be a winner!

As must now be clear, this book owes its publication to many hundreds of contributors, past and present, only some of whom we have been able to acknowledge here. To all who have helped, please accept our sincere thanks for your support.

Special recognition must be given to Carroll Marsalis of the Tennessee Valley Authority, whose vision and unflagging support have been a source of endless inspiration.

Last, we express our sincere appreciation for the careful, diligent work of our editor Anne Christian Buchanan, and to Julia Diane Hull for coordination of the manuscript development, research and rewrites of key sections, and overall management of the publication process.

Dan Hull
Dale Parnell
February 1991

List of Contributors

DR. CLIFTON BELCHER is currently the State Director of Vocational-Technical Education in the state of North Carolina. His thirty-three years of experience in vocational-technical education have given him the opportunity to serve other positions such as a teacher, education coordinator, Assistant State Supervisor, Assistant State Director, and Deputy State Director. Dr. Belcher has received several awards not only for his part in improving vocational education, but also for his work as an educator/administrator.

DR. JAMES (GENE) BOTTOMS has had thirty years experience in education as a teacher, principal, counselor, administrator, scholar, and researcher at the local, state, and national levels. Dr. Bottoms' current position as Director of the Southern Regional Education Board has given him the opportunity to assist fourteen southern states to improve basic competencies in mathematics, science, and communication. Dr. Bottoms has served in other positions such as Executive Director of the American Vocational Association, Assistant State Director of Vocational Education, State Supervisor of Student Services, State Guidance Consultant, and Dean of Student Services.

DR. MAURICE DUTTON is currently a Senior Research Associate for the Center for Occupational Research and Development. Among his other projects at CORD, Dr. Dutton is responsible for consortium relations in the development of applied-academic curricula and is Project Director for the 2+2 Tech Prep Articulation Workshops. His previous work experience includes: President of a private consulting company that designed, developed, and field-tested curricula for business and government organizations; Coordinator of Programs/Instruction; Assistant Professor; and Public School Teacher.

DR. WALTER EDLING, Director of Programs at the Center for Occupational Research and Development, has been responsible for several postsecondary and adult retraining projects in the last few years. Before his position at CORD, Dr. Edling served as Dean of Instruction at Lorain County Community College where he was in charge of all credit and noncredit instruction and academic affairs. Other positions Dr. Edling has served include Engineering and Educational Consultant, Production Engineer, Instructor, and Associate Professor. Dr. Edling is currently involved in curriculum development for semiconductor manufacturing technicians and adult-retraining programs.

MS. SANDRA EVERETT is the Program Developer for the Advanced Technology Center at Lorain County Community College. She has had an extensive background in industrial training and development, focusing on engineering, manufacturing, and programmable automation. Ms. Everett has held the position of Technical Training Manager with Parker Hannifin Corporation and with Ohio State University's Department of Nuclear Physics. Ms. Everett was recently appointed to the Presidential Advisory Committee on manufacturing through the National Council on Vocational and Technical Education.

MR. GREGORY HARPOLE is the Business and Related Programs Specialist in the Division of Vocational Technical Education at the Oregon Department of Education. He has served as a teacher on the junior high-school level where he first got involved in the development of career-education curriculum. He later became the education coordinator for high schools in two school districts. Mr. Harpole then served fifteen years at the community college in charge of curriculum development and secondary/postsecondary articulation.

MR. DANIEL M. HULL, a Registered Professional Engineer, spent thirteen years working with lasers/optics in the defense, aerospace, and energy fields with companies such as Westinghouse, Sandia Corporation, and Lockheed. Mr. Hull then spent seventeen years designing, developing, and conducting technical training programs for schools, industry and government labs. He directed the development of instructional curricula and over 4000 pages of student/teacher materials in laser/electro-optics, which are currently being used in forty community and technical colleges to train laser/electro-optics technicians. Since 1979, Dan Hull has served as the President of the Center for Occupational Research and Development, a private, nonprofit organization. He has provided assistance to the education departments of many states, and to technical institutes and colleges in the implementation of advanced-technology curricula.

DR. DAVID INGRAM has served as the Project Coordinator for the 2+2 Articulated Health Occupations Project at Paris Junior College since 1988. Dr. Ingram's thirty-two years of educational experience include positions such as teacher, coach, and principal in the elementary and secondary levels. For ten years, Dr. Ingram served as the assistant superintendent for curriculum and instruction in the Paris Independent School District. Dr. Ingram served four years in the Air Force.

DR. DOUGLAS JAMES is currently the Superintendent of Richmond County Schools in Hamlet, North Carolina. For the past seventeen years, Dr. James has served in five school districts in North Carolina as a teacher of business education, principal, assistant superintendent, and superintendent in two different school districts. Among his numerous awards are included The Governor's Award for distinguished meritorious service to the people of the State of North Carolina, The United States Department of Education Award for his outstanding contribution to improving the quality of educational opportunities for disadvantaged and migrant children, and The 1988 Governor's Program of Excellence in Education for the development and implementation of "Tech Prep."

MR. STEVE MALBROUGH is currently the Dean of Instructional Support Services at Texas State Technical Institute/Waco. Among many of his projects, Mr. Malbrough is responsible for the development, implementation, and ongoing process involved in the Transformations program, a technical retraining program for adults.

MR. ELBERT MARCOM is the Dean of Vocational and Technical Education at Austin Community College. He has played an active and key role in the development and implementation of the TPAD program and partnership between Austin Community College and Leander High School. Mr. Marcom spent fifteen years in health administration with the Texas Education Agency before joining ACC.

MS. JUDY MARMARAS is currently Director of a statewide TPAD program at the Community College of Rhode Island. Previous to this position, Ms. Marmaras developed and coordinated a reentry college program for single parents, coordinated annual summer youth enrichment/employment programs, and taught in elementary, secondary, and adult education.

MR. CARROLL MARSALIS is the Project Manager for High Technology Work Force Retraining Demonstrations at the Tennessee

Valley Authority. A great deal of Mr. Marsalis' efforts have been directed toward training adult workers to be placed back into the work force. He has developed and orchestrated several projects in the South that would provide training for technical literacy in microelectronics, robotics, laseroptics, and telecommunications. Prior to joining TVA, Mr. Marsalis held six different administrative positions at colleges in the Southeast, including Dean and Assistant President.

DR. LARRY McCLURE is currently the Director of the Education and Work Program at Northwest Regional Educational Laboratory (NWREL) which serves the states of Alaska, Idaho, Montana, Oregon, and Washington. Prior to joining the Laboratory in 1972, Dr. McClure served as a teacher and state department of education staff member. Dr. McClure has worked with dozens of school districts, community colleges, and other agencies to strengthen curriculum and instructional programs.

MR. AL MILLER is currently Director of Instructional Support at Hillsboro High School. Since 1973 he has been involved in career and vocational education, and conducted student and career assessments. In addition, Mr. Miller has served as president of the Hillsboro Chamber of Commerce and was one of the founders of the Business and Education Compact in Washington County.

DR. HENRY M. (HANK) PADDEN has served as the Vice Chancellor of Personnel for the State Center Community College District in Fowler, California since 1985. Dr. Padden has been an active participant of the educational system for over 29 years; during this time he has held positions such as assistant to the chancellor, superintendent of schools, principal and instructor.

MS. HARRIET PALMER is currently a chemistry and physics instructor at Pendleton High School in Pendleton, South Carolina. Her obvious enthusiasm and genuine interest in teaching has won her several awards including Teacher of the Year in the Anderson, Oconee County School District Four. Aside from her teaching, Ms. Palmer is actively involved in conducting teacher-training workshops.

MS. TARA PARKER has served as Principal/Director of Owensboro Vocational Technical School (Kentucky Tech) since 1988. Her previous experience in education includes positions such as mathematics instructor in both a high school and vocational technical school and guidance counselor in a vocational technical school. Ms. Parker was selected as the Outstanding Vocational Education Counselor in 1985 and given the Outstanding Counseling Services Award for Vocational Counseling Services in 1982 from the Kentucky Personnel and Guidance Association.

DR. DARRELL PARKS has served as Director of the Vocational and Career Education Division at the Ohio Department of Education since 1982. Dr. Parks is the current President of the National Association of State Directors of Vocational Technical Education Consortium (NASDVTEC). He also serves on the Ohio State Superintendent's cabinet, is a member of the State Board of Education's Task Force on the Classroom of the Future, and holds an adjunct professor appointment at Ohio State University.

DR. DALE PARNELL began his professional career as a secondary school teacher. He then served as vice principal, principal, superintendent of schools, Oregon Superintendent of Public Instruction, President of San Joaquin Delta College in California, and Chancellor of the San Diego Community College System. Dr. Parnell has been President of the American Association of Community and Junior Colleges since 1981. As chief executive officer of this association, he has represented 1219 institutions enrolling 11.4 million persons in credit and noncredit programs. In 1985, Dr. Parnell published *The Neglected Majority* which introduced the 2+2 Tech Prep/Associate Degree program. Since then, he has been recognized as a crusader for Tech Prep/Associate Degree as he has traveled across the country encouraging high schools and community colleges to become involved.

DR. LENO PEDROTTI has served as the Senior Vice President for the Center for Occupational Research and Development since 1982. During this time, Dr. Pedrotti has worked as the principal editor and author of *Applied Mathematics* (secondary), *Principles of Technology* (an applied-physics program for the secondary level), and *Unified Technical Concepts* (an applied physics program for the postsecondary level). Aside from curriculum development, Dr. Pedrotti's extensive teaching career resulted in several awards, including the National Science Foundation Faculty Fellowship, the Tau Beta Pi Outstanding Educator's of America, and the Air Force Exceptional Civilian Service Award. Dr. Pedrotti was appointed Professor Emeritus, Air Force Institute of Technology upon his retirement from the US Civil Service in 1982.

MR. CECIL PHILLIPS, Assistant Division Chairman of the Engineering Technologies Division, has been with Thomas Nelson Community College since 1971. He spent the first four years of his twenty-three years in education as an instructor of electronics. Prior to his educational career, Mr. Phillips served six years as an electronics engineering technician with NASA and seven years in the United States Air Force. Mr. Phillips serves on the Hampton School Board in addition to many other committee appointments.

MS. MAGGIE RICE is currently the Curriculum Coordinator for grades K-twelve in the Leander Independent School District. She supervises curriculum development, teachers, testing programs, and administration of federal and state programs. She conducted a workshop on Meeting Individual Needs in Reading, and is actively involved in programs to inform women about nontraditional career choices. Ms. Rice was actively involved in developing and implementing not only the TPAD program at Leander High School, but also the successful and ongoing mentoring program.

MR. CHARLES ROUSE is currently the Principal of Leander High School in Leander, Texas. He has spent over twenty-five years in education and twenty years in secondary administration. Mr. Rouse is a member of the Board of Directors of the Texas Association of Secondary School Principals. Not only has Mr. Rouse participated in TPAD-related projects for the past seven years, but he was instrumental in developing the first 2+2 program in Texas at Leander High School.

DR. WILLIAM (BILL) SEGURA has served as President of Chemeketa Community College, Salem, Oregon since 1983. He began his professional career as a teacher/coach, and continued to serve positions as Director of Residential Care at Youth Adventures Inc., Counselor and Director of Counseling at Chemeketa Community College, Assistant to Associate Provost at the University of Oregon, and Director of Outreach and Community Development at Chemeketa Community College.

MS. SUE SHIELDS is the Assistant Principal of the Owen Sabin Occupational Skills Center in Milwaukie, Oregon. Her professional background includes experience as a teacher, counselor, and assistant principal in the Dulles, Salem, Pendleton, and Milwaukie public schools.

MR. ALAN SOSBE, Research Associate at the Center for Occupational Research and Development, has managed, developed, and implemented dislocated worker retraining programs at four different sites around the country. In addition to organizing a 2+2 articulation national workshop, Mr. Sosbe has assisted in the development and implementation of TPAD programs in Austin, Texas and in Oklahoma City. Mr. Sosbe's previous work experience includes positions as a Metallurgical Technician, a Training Development Specialist, and a United States Army Reserve Senior Engineering Equipment Mechanic.

MR. SAMUEL VIGIL has served as the Chief Executive Officer of Luna Vocational Technical Institute since 1974. He has had thirty years of experience as an educator/administrator at the elementary, secondary, and post-secondary levels. Since 1970, Mr. Vigil has been a member of the New Mexico House of Representatives where he was appointed Chairman of the House Education Committee, Member of the Legislative Finance Committee, and Member of the Legislative Education Study Committee.

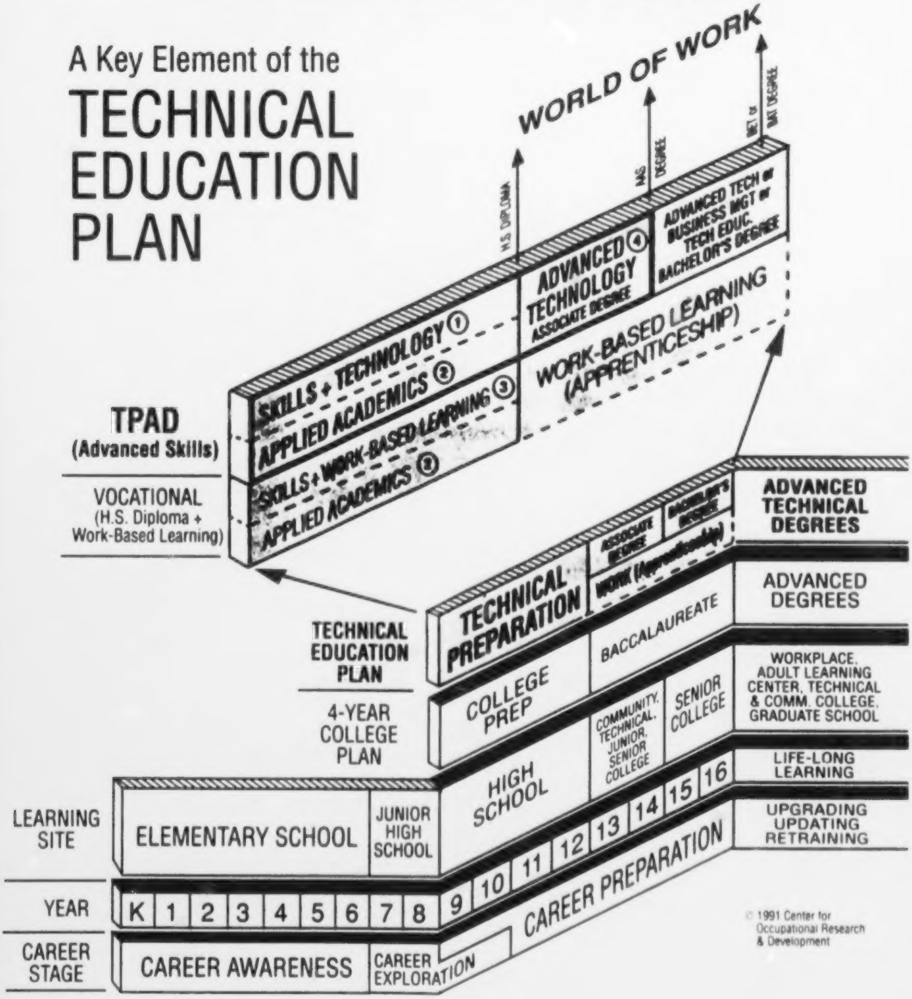
MS. DIANA WALTER, Executive Director of the Partnership for Academic and Career Education (PACE), has facilitated the development of TPAD programs in Anderson, Oconee, and Pickens counties of South Carolina for the past two years. Previous to her work at PACE, Ms. Walter held positions in community-college teaching, administration, and counseling. Her diverse background includes experience in program development, faculty/staff development, student assessment, advising, marketing, and grants development.

DR. J. FRANK YEAGER has been the Superintendent of Schools in the Owensboro Independent School District, Owensboro, Kentucky since 1984. Dr. Yeager's extensive professional career includes his experience as a high-school teacher in Kentucky and Indiana and a college instructor at schools such as Duke University and the University of North Carolina at Chapel Hill. His administrative experience includes positions such as Deputy Superintendent of the Louisville Independent School District and Superintendent of the Durham County School District. Among Dr. Yeager's many honors have been "National Superintendent of the Year" and "One of North America's One Hundred Top School Executives."

TECH PREP/ASSOCIATE DEGREE (TPAD)
The K-12. . . 14. . . 16 Connection

A Key Element of the

TECHNICAL EDUCATION PLAN



WORLD OF WORK

H.S. DIPLOMA

AAS DEGREE

BET or BAT DEGREE

TPAD
(Advanced Skills)

SKILLS + TECHNOLOGY ①

APPLIED ACADEMICS ②

ADVANCED TECHNOLOGY ④
ASSOCIATE DEGREE

ADVANCED TECH or BUSINESS MGT or TECH EDUC. BACHELOR'S DEGREE

VOCATIONAL
(H.S. Diploma + Work-Based Learning)

SKILLS + WORK-BASED LEARNING ③

APPLIED ACADEMICS ②

WORK-BASED LEARNING
(APPRENTICESHIP)

TECHNICAL EDUCATION PLAN

TECHNICAL PREPARATION

ASSOCIATE DEGREE

BACHELOR'S DEGREE

WORK (Apprenticeship)

ADVANCED TECHNICAL DEGREES

4-YEAR COLLEGE PLAN

COLLEGE PREP

BACCALAUREATE

ADVANCED DEGREES

LEARNING SITE

ELEMENTARY SCHOOL

JUNIOR HIGH SCHOOL

HIGH SCHOOL

COMMUNITY, TECHNICAL, JUNIOR, SENIOR COLLEGE

SENIOR COLLEGE

WORKPLACE, ADULT LEARNING CENTER, TECHNICAL & COMM. COLLEGE, GRADUATE SCHOOL

LIFE-LONG LEARNING

UPGRADING UPDATING RETRAINING

YEAR

K 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

CAREER STAGE

CAREER AWARENESS

CAREER EXPLORATION

CAREER PREPARATION

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TECHNICAL EDUCATION PLAN LEGEND

① **Technology (Clusters)**
i.e.
Electronics, hydraulics, graphics
Health
Business

② **Applied Academics**
i.e.
Applied Math 9-10 grades
Principles of Technology 10-11 grades
Applied Biology Chemistry 9-10 grades
Applied Communication 10, 11 or 12 grade

③ **Skills + Work-Based Learning**
i.e.
Masonry
Machining
Welding
Secretarial
Food Service

④ **Advanced Technology**
i.e.
Telecommunications
Computers
Manufacturing
Lasers/Optics
Nursing
Information systems

Tech Prep/Associate Degree: The K-12...14...16 Connection

Most people regard public education as preparation for life and work. In an overall sense, elements of career education begin in kindergarten, extend for as much as sixteen years and continue, in an intermittent fashion, throughout adult life. The proposed educational model shown here considers the K-6 (elementary) grades as a time for developing career awareness, where children learn about occupations and how they relate to personal interests. The model sees the seventh and eighth (and sometimes ninth and tenth) grades as years when students explore career options/requirements and prepare to make choices for their future education/training. From the ninth grade on all students should be following a program of study that will prepare them for specific careers—studies that blend appropriate academics with appropriate skills and knowledge in a particular career area.

All students in high school should be preparing for life and work after high school graduation. This assertion eliminates any justification for a "general plan" of studies that in theory "leads anywhere" but in fact "leads nowhere." Students should either be in a college-prep/baccalaureate plan or in a technical preparation plan.

One group of technical preparation students (the future professional technicians) should be enrolled in a Tech Prep/Associate Degree program that provides them advanced skills through studies and experiences in applied academics, skills and advanced technology. These students could join the workforce after grade 14 or continue their formal preparation by working toward a Baccalaureate in Applied Technology.

Another group of technical preparation students (future workers in crafts, human and business services) should pursue vocational education and training through studies and experiences in applied academics, skills and, possibly, work-based learning. Most of these students will enter the workforce after high school graduation, but likely will return for more education/training according to the demands of the workplace.

Are we suggesting three tracks for students in high school? Not really, we think there should be only one track—Career Preparation! But we believe that this one track should feature options that relate to student interests and abilities—and workforce requirements. Some people still may judge this model to be a three-track system. If you insist on the interpretation of an educational model using "track semantics," please recognize that any courses or program of studies in a model must provide the flexibilities (or options) that students may "jump tracks" if their interests, abilities, resources or confidence indicate to them that they can—and should—reach higher or farther. We believe that the Technical Preparation Plan model meets that requirement.

This model, showing all high school students in career preparation, embodies a higher expectation and greater opportunities for the two-thirds of all high school students who are not in a college-prep/baccalaureate plan.

This book focuses on the Tech Prep/Associate Degree—or TPAD, for short. We believe that TPAD offers to this country, in this decade, the greatest opportunity for educational reform for the most neglected students in public education—the average students. Contrary to what the doom-sayers would have you believe, these average students are not "half bad"; they are just the "half educated," the vital future grass roots, backbone of the American work force—and they deserve a better education than they are presently receiving.

1

EVERY STUDENT A WINNER

The Case for TPAD

Dale Parnell

"The development of TPAD programs, which emphasizes five "Cs"—

- *Continuity in learning,*
- *Context-based teaching (applied academics),*
- *Competency-based teaching,*
- *Communication between learning institutions (especially between high schools and postsecondary institutions), and*
- *Completion of the program with an associate degree—*

offers students another definition of educational excellence. It is true curricular reform."

1

Five substantial enemies stand in the way of excellence in the modern American school and college educational program.

First, we have allowed the traditional college prep/baccalaureate degree curriculum to be the one and only definition of excellence in education.

Second, in too many instances, we have allowed the curriculum to become disconnected from real-life issues. Teaching and learning in formal education usually take place outside the context of real-life situations, activities, and problems. Studies have shown, however, that most individuals learn best when they are taught in a context of application.

Third, scant attention has been given in education to the subject of continuity in learning. As a result, American schools and colleges have become a collection of disjointed courses that, more often than not, fail to connect with one another and with the students they want to teach.

Fourth, little attention has been given, in defining educational excellence, to the pressing dilemma of how to meet the great range of individual difference among students.

Fifth, we have allowed too many students—even those in so-called vocational education programs—to graduate from secondary schools and even postsecondary programs without the competencies required to secure entry-level employment in a rapidly changing environment, or the flexibility to retrain later as job-market requirements change. This group of students can be called "the neglected majority."

Happily, there is a movement afoot to face down these enemies of excellence—an educational plan that:

- offers a first-rate alternative to the traditional college-prep program for students who are unlikely to achieve a baccalaureate degree,
- offers students a solid academic foundation based on concrete, real-life applications,
- coordinates the efforts of secondary and postsecondary schools to achieve maximum results in minimum time,
- effectively addresses some of the key differences in student needs, backgrounds, and learning styles, and
- provides students with the lifelong learning competencies they need and the flexibility they will need in the future—while providing employers with the kind of workers they need to remain competitive.

The program that offers all this is an articulated Tech Prep/Associate Degree (TPAD) curriculum. It represents the wave of the future in educational excellence, and it has been successfully tested in communities across the nation. The purpose of this book is to show how a TPAD system can be established in your community.

TPAD is essentially a new approach to what has sometimes been called vocational education—education aimed at helping students develop career competencies. Unfortunately, vocational education was born in America with a fundamental birth defect: prestige deficiency. Despite the best efforts of vocational educators, the general public still perceives vocational education as a program for someone else. (Isn't it interesting that we label it vocational education for youth and career preparation for adults?)

Several unfortunate images get in the way of clear thinking about vocational education. Far too many people still see vocational education as a group of boys gathered around an old car. They see vocational education as limited to working with the hands—totally removed from the "head" work of academic subjects.

A second fallacious image of vocational education can be called the "footstool and end table" image. This image limits the definition of vocational education to "fooling around" in a hobby course like woodshop.

Some people have developed what might be called the "dumb/smart" image. As far as they are concerned, vocational education is for the "dumb kids," while so-called academic education is for the "smart" ones. We have yet to eliminate the words *dumb* and *smart* from our educational vocabularies, although the discoveries over the past thirty years about learning and the process of intellectual growth should have moved us beyond these self-defeating labels.

Some secondary school administrators have developed what might be called the "dumping ground" image for vocational education, which is closely related to the "dumb/smart" image. In some high schools, one could well retitle vocational education classes to Dumping Ground I for the sophomores, Dumping Ground II for the juniors, and Dumping Ground III for the seniors. These classes become a place where students are "dumped" when school counselors and administrators do not know what else to do with them. The vocational teacher may be good at handling students with behavioral problems; thus "shop" is where the behavioral problems are dumped.

Isn't it time to ask how many of these behavioral problems are created because students see little purpose, slight meaning, and meager real-world application in the school program? Does the student see a purposeful relationship between the challenges of real life and his or her schooling experiences? Isn't it time that the educational community developed an alternative concept of excellence in education that helps students learn within the context of real-life experiences and is applicable to all students—not just the college bound?

UNREALISTIC IMAGES OF EXCELLENCE

Of course, the educational community is not alone in forming unrealistic images of excellence and imposing them on the American people. The Madison Avenue ideal of a thin, attractive, white family, confident and happy in a meticulously landscaped and spacious suburban home, has pervaded the American consciousness. Each morning, after a breakfast which provides fiber and builds bodies twelve ways, two children, perfectly groomed, emerge from a model kitchen and skip off to the neighborhood school. Presumably, within the allotted time they will graduate. Then, with little or no effort, they will continue their education at an elite four-year college or university.

Faced with such an artificial image, one can understand the chagrin and frustration of many students, who have never entered such a world, and of the local school-board member who stood up during a school-board meeting and informed his colleagues, with tongue firmly in cheek, "I am so disgusted with our schools. Why, do you know that half of our students are below average?"

Increasingly, in our pursuit of "excellence," we have come to consider "average" as an accusation. We want to strive for excellence.

And yet our understanding of excellence is often shallow and artificial.

The television and movie image of excellence portrays fun and games as the standard way of life and celebrates the antihero. The multimillionaire athlete, movie star, or rock star with live-in boyfriend or girlfriend becomes the standard role model for our young people. Reading, writing, and arithmetic can't help but run a slow third to the more dramatic skills of Indiana Jones and the Beverly Hills Cop.

The news image of excellence stresses form over substance. The "photo opportunity" is more important than the message. How someone looks is far more important than what he or she says. With a thirty-second sound bite the common denominator of media communication, the superficial too often rules.

Even our understanding of excellence in higher education suffers from some distorted and superficial criteria. In some institutions of higher education, the definition of excellence in education begins and ends with the admissions process. Excellence will be more or less automatic if the initial screening process has been thorough enough in sorting out the academically talented from the not so talented.

There is nothing inherently wrong with tough admissions standards as long as we do not allow college-entrance requirements to be viewed as the only arbiters of excellence in a universal education system. The comprehensive, open-door high school and the comprehensive, open-door community college must work on the basis of a not-so-visible or dramatic definition of excellence. They must seek the development of a highly diverse potential in all students, not just some of them. Certainly these schools and colleges want a well-prepared entering student. However, there are many kinds of talent and many kinds of excellence to be developed and celebrated.

It's understandable how our understanding of educational excellence came to be limited to college prep/baccalaureate degree programs. Assuming that most people think and act as we do is a common human failing, and leaders in the field of education are not immune from it. They have experienced the baccalaureate-degree program and therefore expect that their experience is the best possibility for everyone.

As a result, educational policy formation has nearly become the monopoly of college and university graduates who appear to believe that academic excellence must be described primarily in terms of the kinds of education they themselves acquired. The great debate about excellence in education is closer to a monologue of one-sided opinions expressed by well-meaning individuals and groups who have little contact with non-baccalaureate-degree America. These educational leaders insist that their own university-centered educational experience and view of life in some way reflect the tremendous diversity of this great nation. But the richness of American life cannot be captured in one autobiographical dose of classical education medicine!

ONE APPROACH DOES NOT FIT ALL

A college prep/baccalaureate degree program is certainly the road to excellence for many individuals, and our schools and colleges must help these students prepare for this direction in life better than ever before. Indeed, community colleges are actively pursuing programs to encourage and motivate more community college students to press on to the baccalaureate degree.

But educators at all levels must constantly be reminded that the majority of the population will never earn a collegiate-level baccalaureate degree. These students also want and need an excellent education, but one that is applicable to their talents and future. What can schools and colleges offer them? Is the educational crisis of the year 2000 being created today by continuing to insist there be only one definition of excellence and that one kind of educational program be applicable to all students?

K. Patricia Cross, professor at the University of California, Berkeley, Graduate School of Education, offers a pungent observation on this subject:

> In the final analysis, the task of the excellent teacher is to stimulate "apparently ordinary" people to unusual effort. What do the reports on school reform have to contribute to that goal? In the first place, there is surprisingly little attention given to "ordinary people" in the school reform reports. There is the clear implication that the rising tide of mediocrity is made up of embarrassing numbers of ordinary people. Teachers' colleges are advised to select better candidates, colleges are encouraged to raise admissions standards, and the federal government is urged to offer scholarships to attract top high-school graduates into teaching. There is not a lot said in the education reports about how to stimulate unusual effort on the part of the ordinary people that we seem to be faced with in the schools and in most colleges . . . The tough problem is not in identifying winners; it is in making winners out of ordinary people. That, after all, is the overwhelming purpose of education. Yet historically, in most of the

> periods emphasizing excellence, education has reverted to selecting winners rather than creating them.[1]

In the medical world, any physician recommending the same medicine or pill for all illnesses would be sued for malpractice. And yet former Secretary of Education William Bennett's 1987 recommendation of one high-school curriculum for all students was the educational equivalent of such a practice. His plan demonstrated an alarming lack of knowledge about the diversity of the public-school and community-college populations and the differences in how people learn. To compound the problem, Bennett indicated that those who disagree with his "one curriculum fits all" philosophy are against high standards and high student expectations!

Certainly students need both substance and structure in their school and college programs. They must be challenged and motivated to do their best. But do they all need the same dose of theoretical subject matter? Should they all be taught in the same way with the same curriculum?

The "one education fits all" educational philosophy has motivated educational leaders into using Scholastic Aptitude Test (SAT) and American College Test (ACT) results as the basis for value judgments about the quality of education a school offers, despite the admonitions of the College Board and the American College Testing Service that SAT and ACT scores are not to be used that way. It is a simple fact of life that when "C" students begin taking SATs and ACTs, as an increasing number of students have been doing over the past decade, the national average will go down. If our definition of excellence in education were based solely on SAT and ACT scores, improving American education would be a simple matter of allowing only the top quartile of academically talented students to participate.

Unfortunately many educational leaders have tended to favor the "classical education" ideas of Plato over the more practical notions of Aristotle. The Platonic tradition seems to hold that anything approaching practical education has little or no value in the educational process and therefore in the modern school curriculum. The idea of "applied academics"—academic subjects taught within the context of application—seems anathema to the classical philosophy. Yet, in a universal education system attempting to educate a highly diverse group of students, many students seem unable to connect much of what they learn and experience in the classical education curriculum with the competencies they need to function effectively in their real-life roles as learners, wage earners, citizens, consumers, family members, and healthy individuals.

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[1] Patricia K. Cross, "Societal Imperatives: Need for an Educated Democracy" (Paper presented at the National Conference on Teaching and Excellence, University of Texas at Austin, 1984).

Keith Goldhammer, scholar and longtime observer of the American education scene, rebuts the Platonic philosophy as applied to American schools this way:

> The establishment of a public school system in the United States based upon the Platonic intellectual tradition has tended toward an elitist conception of its functions, has emphasized its selective characteristics, and has at least partially abrogated its responsibility for the 75 to 80 percent of its students who by native ability, interest, and aspiration are identifiable with the practical affairs of our culture rather than inclined toward the more abstract and conceptual activities of the academic disciplines. . . .
>
> That which is needed in today's world is neither a new brand of academicism nor a new style of vocationalism, but a fusion of the two.[2]

No longer can we speak of the liberal arts versus the practical arts as though we live and learn in separate worlds. The students of the future will require both. If we fail to match in any systematic way the goals of schooling with the real-life needs of individuals living in a knowledge-rich but application-poor society, we will fail in our educational calling. All our young people of today require first-rate educational programs that prepare them for that next step after high school—whether that step is a job, an associate-degree program in a community college, or a baccalaureate degree in a university.

A casual observer of American schools and colleges might conclude that excellence in American education can be achieved only by making a majority of students feel like failures and unable to cope with modern life. Anything less than a college prep/baccalaureate degree program is viewed as second-rate. Few of the national educational-reform studies provide workable solutions to the problem outlined twenty years ago by John W. Gardner:

> The importance of education is not limited to the higher orders of talent. A complex society is dependent every hour of every day upon the capacity of its people at every level to read and write, to make difficult judgments, and to act in

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[2] Keith Goldhammer and Robert Taylor, *Career Education, Perspective and Promise* (New York: Charles E. Merrill, 1972).

> the light of extensive information. . . . When there isn't a many-leveled base of trained talent on which to build, modern social and economic developments are simply impossible. And if that base were to disappear suddenly in any complex society, the whole intricate interlocking mechanism would grind to a halt.[3]

Most of us tend to live somewhere between our hopes and our fears. But surely it is possible for our present age to move closer to our universal education hopes and dreams rather than to our fears. Surely we can provide an excellent universal education system for our citizens in all their diversity. The United States has come closer than any other heterogeneous culture to achieving this high goal, but the enterprise must still be called an experiment. We have yet to demonstrate that we really know how to provide a universal education for all people.

The American education system moves along slowly, somewhat like the little English "puffer" tugboats moving through the fog in the days before depth-finders and radar. Usually a young boy was hired to sit on the bow of the "puffer," tossing pebbles first to the right and then to the left to be sure the boat was in the middle of the channel. As our present education system moves through the fog, there seem to be an unusually large number of pebbles being tossed right and left to keep our educational "puffer" from running aground. We have not yet invented the kind of radar that will show us where we are in our universal education effort. Neither have we been able to agree on what the word *excellence* means nor related that agreement to the educational enterprise.

Meanwhile our American society stands sorely in need of an educational excellence that prepares *all* our young people for what the twenty-first century will require of them. The National Commission on Excellence in Education states our present dilemma in this straightforward way:

> More and more young people emerge from high school ready neither for college nor for work. This predicament becomes more acute as the knowledge base continues its rapid expansion, the number of traditional jobs shrinks,

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3. John W. Gardner, *Excellence* (New York: Harper and Row, 1961, rev. 1984).

> and new jobs demand greater sophistication and preparation.[4]

In light of the current situation in today's schools and today's markets, we *need* something new.

NEEDED: AN APPLICATION-RICH EDUCATION

Cognitive-learning research is discovering that intelligence and competence develop best out of interaction between obtaining knowledge and applying that knowledge.[5] This notion challenges some of the time-honored shibboleths and distinctions in education (see sidebar on page 13) and shatters artificial distinctions between:

- "head" work and "hand" work,
- academic and vocational education,
- knowing and doing,
- education and training,
- theoretical knowledge and applied knowledge.

In 1988, some five hundred thirty-five delegates meeting in Geneva, Switzerland came to a similar consensus. This meeting, which included forty-three ministers of education and featured representatives from one hundred twenty-one countries, met under UNESCO sponsorship to consider the subject "Diversification of Postsecondary Education in Relation to Employment." And conference participants concluded that postsecondary education in most countries lacks a sufficiently practical focus. These officials voiced great concern that education, in too many instances, does not help students understand the real-life applications of their learning. Shiv Shanker, Minister of Human Resource Development in India, observed that in many parts of the world there is a wide chasm between education . . . and the need for it in the world of work.

Washington Post columnist William Raspberry comments in a graphic way about this problem:

> Add one more thing to the list of awful things we are doing to our young people. We are teaching them contempt for manual labor . . . we teach all our children as though we expect them to go to college and train for the

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[4] David P. Gardner et al., *A Nation at Risk: The Imperative for Educational Reform,* report of the National Commission on Excellence in Education (Washington, D.C.: Government Printing Office, 1983).

[5] See the references on this subject listed in Appendix D.

> professions. . . . We count it an insult to suggest to our children that they might think of a career as an electrician or a plumber or a transmission specialist—not because these jobs don't pay enough (anyone who's had to have his car or his pipes fixed knows better) but because they lack prestige. . . . And we wonder why so many of them are wasting their lives as small-time hustlers or else killing themselves at such an alarming rate by trafficking in drugs.[6]

When will we learn in this country that we must meet the educational needs of the neglected majority (75 percent in most places) of high school students who are not likely to earn a college baccalaureate degree? If the sole purpose of education is to prepare students for college baccalaureate degrees and graduate studies, our educational system is a failure by design, leaving the majority of students unprepared for the jobs of the future—or even for the next step in education.

A few communities, school systems, and colleges are recognizing and enhancing the talents of those students who will be working with their hands as well as their heads. But more, much more must be accomplished. Part of the answer lies in developing first-rate Tech Prep/Associate Degree programs that combine competency-based teaching, articulated programs between secondary and postsecondary institutions, and an excellent foundation of applied academics. Indeed, some states such as Delaware, North Carolina, South Carolina, Oregon, Rhode Island, and Wisconsin are beginning to develop the TPAD program on a statewide basis. Such programs—drawing upon the shared resources of high schools, community colleges, and the employer community—can help develop to a higher level a much needed world-class work force in the United States.

A recent poll conducted by the National School Boards Association revealed that a whopping 92 percent of local school policy makers support programs that would encourage secondary and postsecondary schools to develop applied academics courses and better coordinate vocational-technical education programs. School and college leaders must roll up their collective sleeves and go to work to design such programs, while developing their own highly effective alternative definitions of excellence. This book is designed to aid development of such programs.

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[6] William Raspberry, "Skimming the Underclass," *Washington Post*, 28 November 1984.

Educational Shibboleths and Realities

Educational Shibboleths	Educational Realities
1. One classical school curriculum will meet the needs of all students.	1. Students need more structure and substance in their school programs, but presented in context so they can see the application of their learning.
2. All students learn at approximately the same rate.	2. There are vast individual differences among students of any age in speed of learning and comprehension of knowledge.
3. All students learn the basic skills by completion of the elementary grades.	3. Development of basic skills must be placed upon a continuum of learning, with students arriving at different points at different times. Excellence in education requires breaking the lockstep of arbitrary time requirements for learning.
4. Students who fail to achieve in school either do not want to learn or are unable to learn.	4. Research programs suggest that, given adequate time and context for learning, and favorable learning conditions, 95 percent of students can achieve mastery of any basic skill, particularly if they understand the "why" of their learning.
5. The traditional classical textbook and lecture method of instruction is the most effective method of teaching for most students.	5. Some students learn rapidly by one method of instruction and more slowly under a different approach. However, after fifteen years of experimentation and experience in more than three thousand schools, contextual teaching/learning appears consistently more effective than classical instruction.
6. Real excellence can be found only among those students and programs related to pursuance of a college baccalaureate degree.	6. Some new definitions of excellence are needed. Every school and college program must develop standards of excellence. Excellence is just as important to the aircraft technician as to the engineer. The notion of excellence must be extended to every course and each student.

It is clear that life roles in one form or another remain the central and dominating force in the lives of most human beings . . . and form the context for learning. Thus, the requirements for functioning effectively in these various life roles, starting with the career role, should be the beginning points for any discussion of educational goals. One reason for frequent expressions of dissatisfaction with

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modern schools is that we have failed to match in any systematic way the goals of schools with the real-life needs of individuals living in our modern society. We have allowed education to become disconnected from real life, real work, and real citizenship . . . the ideal context for learning.

We live in a knowledge-rich and application-poor society. Young people acquire so much information from the modern media that many suffer from data overload. They are often not emotionally equipped to assimilate or to interpret all they see and hear . . . without the personal experience that provides realistic perspective. This is yet another reason to challenge educators at all levels to design a high-school and college curriculum that is application-rich as well as knowledge-rich.

Educators sometimes seem to depict learners as empty containers into which knowledge may be poured. But learning actually occurs when the learner constructs and solves real-life problems. Learners bring their own life experiences to the learning situation. For example, individuals form their own ideas about such phenomena as light, heat, or electricity. Their ideas are personal and derived from their own experiences. Classical education is usually based on a presentation of the subject matter that ignores what is already in learners' heads, with the result that students often fail to make the connection between their memorized knowledge and unfamiliar problems confronting them. As a result, students can solve "book" problems by rote application of formulas, but when faced with a real-life problem to which their formal instruction seems irrelevant, they revert to their original conceptions and experiences.

Although "learning to know" and "learning to do" are too often separated, little long-lasting learning or understanding occurs without connecting the two. When classroom learning becomes detached from meaningful context, learning is reduced to a process of memorizing rules and isolated facts. Those students whose educational experience enables them to see the connectedness of things will have a distinct advantage in the future.

William Aldridge, former executive director of the National Science Teachers Association, comments on the classical subject-by-subject approach often used in teaching science and on the need to make learning more effective by helping students understand the connectedness of facts and applications:

> The fundamental problem with high school biology, chemistry, and physics courses is that they are not coordinated, are highly abstract and theoretical, do not spend enough time on each subject, and do not use correct pedagogy. In short, we never give students the chance to

> understand science. . . . Most people are able to learn physics, chemistry, biology, geology, and other related subjects. People can learn how these subjects apply to their lives and to society's problems. If we teach science to all students in a coordinated way from the concrete to the abstract, with practical applications, our future citizens will be more evidence-oriented. They will know how and when to ask questions, how to think critically, and then how to be able to make important decisions based on reason rather than on emotion or superstition. Science made understandable and accessible to all will also mean more and better scientists and engineers—and a different mix among them, including larger numbers of underrepresented groups such as women and minorities.[7]

Educators simply cannot allow the debate about the importance of the liberal arts and the practical arts to degenerate into an either/or argument. They are both important, and balance is needed. Education excellence must be defined in terms of connectedness and applicability, particularly for that large student population that does not work as well, nor as effectively, in the abstract. The liberal arts and the practical arts absolutely need each other . . . and cannot continue to operate in isolation.

Students enrolled in technical education programs must meet the same basic requirements as other students seeking the high-school diploma, but these competencies must be developed in an applied-academics mode. A course in business-letter writing can be rigorous and help students demonstrate writing skills. A course in business mathematics can also be rigorous and help students master computing percentages or applying statistical methods. An applied-physics course can be rigorous and help students master essential academic knowledge through practical experiences. *Connectedness, context*, and *continuity* are key words in reshaping curricula and improving the education program, particularly for the two middle quartiles of students.

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[7] William Aldridge, "Essential Changes in Secondary School Science: Scope, Sequence, and Coordination" (Paper presented to the National Science Teachers Association, Washington, D.C., 1989).

NEEDED: BETTER CONTINUITY AND COMMUNICATION IN EDUCATION

Given the tremendous gaps in the continuity and substance of many students' learning, it is amazing that they learn as much as they do. A close correlation has been established between loss of continuity in learning and poor grades. In fact, irregular class attendance is an early signal of course failure and eventual dropping out. High-school principals report that poor student attendance remains a key problem affecting the quality of education in their schools.

However, scant attention has been given this subject in the major reports on educational reform. In 1982, the National Center for Education Statistics asked five hundred seventy-one school districts, on behalf of the National Commission on Excellence, which policies or procedures were most important for improving academic achievement. Increased daily class attendance and improved continuity in learning were listed as most important by 66 percent of the overall sample and 90 percent of the urban school districts.

It is a fairly safe bet that overall student achievement-test scores would improve dramatically in most schools if student attendance patterns improved. And on skill-acquiring levels, which are important in most vocational-education and applied-academics programs, continuity in learning is vital. If the student misses one or two basic steps, the next steps become increasingly difficult to negotiate. As a consequence, one out of three or more students in our schools is constantly endeavoring to catch up. It is sad that most of these students spend the rest of their lives attempting to catch up and never really do.

Fred Hechinger, long-time observer of the American educational scene, has commented on the loss of continuity in learning:

> We are not very good at continuity. . . . As a result of that, American education during the past few decades has become a collection of disjointed parts that in the main fail to connect. . . . The lack of continuity that plagues American education is something that all of education needs to address. Instead of connecting the separate levels, critics generally compound the spirit of separation by seeking scapegoats instead of remedies. . . . If we want to reform the schools, two things are essential: continuity, all the way up the line; and understanding the "why" of every single course. Read Bruno Bettelheim on that. Whatever you teach, make the children understand why they are

> studying it. Don't tell them: "You'll need it later." Later doesn't exist."[8]

Of course, this general problem of continuity in learning has many facets. Our mobile society, for instance, contributes to a tremendous loss of continuity in learning; an estimated 20 to 30 percent of public school students attend more than one school each year. Since schools by and large operate on the basis of local control and local autonomy, these students almost invariably experience a totally different curriculum as well as a new environment, a new set of peers, and new teacher or teachers. Under the best of conditions, learning is bound to suffer at least temporarily.

The continuity gap between secondary and postsecondary schools is another important breach in the learning continuum. For some students, the gap between high school and college must seem like the Grand Canyon. A chasm also yawns between high-school and college faculty. As a rule, high-school teachers talk with high-school teachers, community-college instructors talk with community-college instructors, and university professors talk with university professors. It is only by much effort that such educational communication lines are crossed.

Much of this distance can be attributed to the fragmented nature of our educational system, which tends to inhibit communication among the various entities. Unlike European systems, which operate their schools under central ministries of education, the American education system is highly decentralized. More than fourteen thousand independent school districts and twelve hundred dependent school districts (subject to the fiscal control of county or city government) operate across America. In most states, responsibility for the actual operation of the schools has been delegated by the various states to local school districts. (An exception is Hawaii, which has a single statewide school system.)

There are more than twelve hundred public and private two-year community, technical, and junior colleges, almost two thousand public and private four-year colleges and universities, and an estimated six thousand proprietary (private) career schools. The private colleges operate in a largely autonomous manner. The public two- and four-year colleges operate under local boards of trustees, or as part of a state university system or independent state system.

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[8] Fred M. Hechinger, "School-College Collaboration . . . an Essential to Improved Public Education," *National Association of Secondary School Principals Bulletin*, October 1984, 69-79.

Institutional fragmentation is also heightened by fragmentation within the schools themselves; many have observed that there is no organism on earth more autonomous than a professor in a major university.

As a consequence of this highly decentralized educational structure, communication among and between the various entities and personnel of our national education system becomes exceedingly difficult. Poor communication persists between the various educational entities. Even more serious, there is a subtle but stubborn provincialism that suggests that program articulation, the careful building of bridges between high schools and colleges, is extraneous to the primary mission of either group.

High schools generally do not have a good sense of how students perform once at college or in the work world because the colleges and universities, with rare exception, do not keep them informed. Community colleges, who often deal with students who have failed to reach their own or others' expectations upon high school graduation, are particularly lax in letting high schools know how their former students are doing.

As a result of this overall fragmentation and lack of coordination between educational entities, student learning suffers. Generally speaking, although the high-school courses a student takes often do not seem important in getting him or her into a community college, they may be absolutely critical to success once the student is there. Yet there is precious little communication to high-school students from the community, technical, and junior colleges about how high-school preparation relates to success in these higher-education institutions.

NEEDED: A HIGHLY EDUCATED WORK FORCE

Postsecondary education and training have become integral to a majority of the work force, whether they be nurses, law-enforcement officers, electronics technicians, aircraft technicians, computer operators, auto-service personnel, or marketing representatives. IBM now requires each technician, marketing representative, and systems analyst in that large corporation to spend nineteen to twenty days (one working month) in education and training programs each year. And IBM is not alone in requiring such programs of its employees. Such widely diverse companies as State Farm Insurance, Southwest Forest Industries, Manufacturers Hanover Trust Company, Abbott Laboratories, Central Illinois Light Company, Citicorp, Steelcase Inc., Valley National Bank of Arizona, and Caterpillar Tractor Company all are moving education and training programs into high-priority positions in terms of strategic planning for future economic growth.

It is estimated that thirty to forty billion dollars is spent annually by U.S. public and private employers for employee education and training programs. This figure does not include costs for training in the military. The Department of Defense estimates that it spends an additional fifty billion dollars per year on education and training. Public and private employers are concluding that more fully developing the competencies and related performance of the work force will be the major factor in determining the future health of their enterprises.

More and more secondary schools and community colleges are waking to the need to cooperate in developing curricula appropriate for this new technological world. It is absolutely imperative that high schools and colleges—particularly community, technical, and junior colleges—become aggressive in examining, developing, and sustaining quality educational programs to serve that great host of Americans who keep this country working.

Key to this new educational thrust will be the associate degree. Although this educational goal has been around for some eighty-five years, it has not become well known until the past twenty. The arrival of the new "learning age" and the proliferation of technician-level education programs have spurred interest in this two-year degree. They have also led to the establishment of a variety of associate degrees such as the Associate in Computer Science, the Associate in Business, and the like.

What is an associate degree worth today? Dramatic statistics released recently by the United States Department of Commerce reveal that the associate degree continues to gain significant ground as an important employment credential. For example, the average monthly earnings difference between the associate-degree holder and the high-school graduate jumped from $304 to $537 per month between the years 1984 and 1987. Over the same three-year period, the difference in monthly earnings between associate-degree and vocational-certificate holders nearly doubled—jumping from $198 to $370, while the difference in earnings between associate-degree and bachelor-degree holders remained fairly constant. Probably the most dramatic earnings difference was between *the associate-degree holder and the high-school dropout; this gap has widened from $773 in 1984 to a whopping $1,006 per month in 1987!* We should be shouting this difference in earning power loudly enough for every potential high-school dropout in the country to get the message (see figure 1).

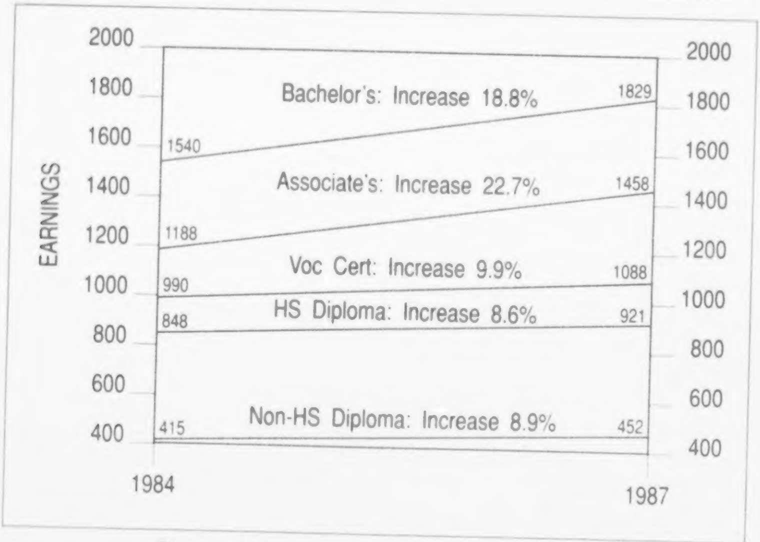

Figure 1: Differences in Average Monthly Earnings by Educational Level—1984 and 1987[9]

In the United States, the associate-degree program is a growing educational enterprise. During the decade of the 1970s, the number of associate degrees awarded increased by approximately 60 percent, compared with an increase of eleven percent for the baccalaureate degree. In fact, the number of associate degrees, which accounted for more than 18 percent of all degrees in 1970, grew to 23 percent by 1980. Among all the college degrees awarded during the decade of the 1980s, the number of associate degrees awarded increased by the largest percentage, 8.4 percent, followed by a 6.3 percent increase in baccalaureate degrees and a 4-percent drop in master's degrees (see figure 2).

The public has also given the associate degree a vote of confidence. In 1984, the American Association of Community and Junior Colleges, along with the College Board and the Council for Advancement and Support of Education, commissioned Group Attitudes Corporation of New York to conduct a random-sample public-opinion telephone survey of 1,006 persons aged eighteen or older. One principal finding of the survey was that Americans show great confidence in community, technical, and junior colleges and believe that these

[9] Chart based on U.S. Department of Commerce, Bureau of the Census, *Current Populations Report*, 1990.

institutions offer quality education at a reasonable cost. Four out of five individuals polled (80.9 percent) felt that an associate degree is really useful in helping a person transfer to a four-year college or university. Three out of four (75.9 percent) felt that such a degree is also useful in helping a person procure a job that requires some expertise or training beyond high school.

Year	**Associate's**	**Bachelor's**	**Master's**	**Doctorates**
1979	402,702	831,340	302,075	32,756
1989	436,462	989,000	290,000	33,600
Decade Percent Increase	8.37%	6.28%	–3.99%	2.57%

Figure 2: Degrees Awarded During the Decade of the 1980s[10]

In addition, many employers are beginning to specify "Associate Degree Preferred" in help-wanted ads. Employers see the associate degree as "quality assurance"—a sign that individuals can read, write, compute, and be technically competent.

The associate-degree program is central to the mission of the community, technical, and junior college. The associate degree reflects the larger goals of educational attainment the institution holds for its students. It is a means through which the institution develops and maintains integrity in its educational programs. The associate degree serves as an important student guide and requires commitment on the part of the student for program completion.

Emphasis upon the associate degree in a TPAD program indicates to teachers, administrators, students, and society that the TPAD consortium has a vision of what it means to be an educated person and affirms the consortium's commitment to program continuity, coherence, and completion. The associate degree, which is awarded only for completion of a coherent program of study designed for a specific purpose, also indicates that the holder has developed proficiencies sufficient to prepare for upper-division collegiate work or to enter directly into a specific occupation with confidence. It is the hallmark of the educated worker who will be the backbone of tomorrow's work force.

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[10] Chart is based on the American Council on Education, *1989–1989 Fact Book on Higher Education*. Figures for 1989 are fairly close estimates.

NEEDED: A MORE FOCUSED HIGH-SCHOOL CURRICULUM

Many leaders of technical education programs in community, technical, and junior colleges are now observing that excellence in technical education cannot be achieved in two college years, given the current preparation level of the students entering these programs. Therefore, a third year is being added to many postsecondary programs. Wouldn't it make educational as well as economic sense for schools and colleges to utilize the high-school years more wisely instead of extending the technical programs to three college years?

In particular, many high-school students indicate that their last year in high school doesn't amount to much. Students tend to arrive at the twelfth-grade point in their high-school experience needing only two or three credits to graduate. As a consequence, the twelfth grade becomes a "goof-off" year, a phenomenon which has seemed to increase since the late 1960s. Far too many high-school seniors are enrolled in unstructured and unfocused courses that lack much substance. Can excellence be cultivated and a first-rate education achieved when half or more of a high-school senior class see their final year as unimportant in terms of learning? With so much to be learned and so many new skills to be developed, school and college leaders must develop new ways to make better use of existing time and resources rather than continuously adding on to programs at postsecondary levels.

Secondary schools are preparatory institutions for all students and not just for the college prep/baccalaureate degree students. Guidance programs must present all high-school students with curricular programs where goals are clear. The guidance program must also be prepared to help students shift their goals from time to time. Aimlessness is a plague of many secondary-school and college students: goals must remain within clear vision of the students.

Educators carry a heavy responsibility to help all students see meaning in their educational programs . . . as well as ensure continuity in learning. Clear goals for the curricular course or program and clear goals for the individual student are absolutely essential to achieving excellence in education.

Student goals will change from time to time, indeed should change, but those changes do not invalidate the need for short-range goals. It is a great disservice to allow students to wander aimlessly through a school or college curriculum making few connections with real-world issues. If we want instructors motivated to teach, administrators motivated to lead, school-board members and college trustees motivated to develop wise policies, and the public motivated to support our schools and colleges, we must pay unrelenting attention to the real-life purposes of education. These purposes must be developed with such precision and clarity that all students, and not just some of them, will be able to develop a sense of personal meaning, involvement, and competence.

NEEDED: A REDEFINITION OF EXCELLENCE

Many academically talented secondary-school students have been well served over the years by the college prep/baccalaureate degree curriculum, but unfortunately we have allowed this one definition of excellence to dominate the secondary-school curriculum. We have attempted to insist that all students must wear one size of educational program shoes. It is clear that one curriculum will not fit the diversity of individual student differences any more than one size of shoe will fit all sizes of feet.

In particular, the two middle quartiles of the typical high-school student body (the neglected majority) have not been particularly well served by the theoretical college prep/baccalaureate degree curriculum; nor have they been well served by the unfocused and watered-down general-education curriculum. Further, because of the image problem of traditional vocational education, few of these students have enrolled in vocational education courses.

As a result, some eleven million students out of the forty million now enrolled in elementary and secondary schools will not even graduate from high school—in part, because of the problem of an unfocused smorgasbord type of curriculum called general education.

The large challenge facing instructors in elementary schools, secondary schools, and to a significant degree in open-door community colleges, therefore, is devising programs that meet the great range of individual differences in every classroom. In desperation, schools have dreamed up labels for various students—"bluebirds, robins, and meadowlarks" or "advanced, terminal, and remedial." To a large extent, they are still missing the mark.

If we are serious about meeting that great range of individual differences in open-door high schools and community colleges, we must cultivate goal-oriented programs flexible enough to match students' diversity. But educators cannot hope to develop such an appropriate educational diversity unless educational excellence is redefined. We must reject the idea that excellence can be found only in certain university-oriented programs or in preparing for certain professions.

John Gardner has distilled some of our best thoughts on the varieties of excellence:

> Though we must make enormous concessions to individual differences in aptitude, we may properly expect that every form of education be such as to stretch the individual to the utmost of his potentialities. And we must expect each student to strive for excellence in terms of the kind of excellence that is within his reach. Here again we must recognize that there may be excellence or shoddiness in every line of human endeavor. We must learn to honor excellence (indeed to demand it) in every socially accepted human activity, however humble the activity, and to scorn shoddiness, however exalted the activity. As I said in another connection: An excellent plumber is infinitely more admirable than an incompetent philosopher. The society which scorns excellence in plumbing because plumbing is a humble activity and tolerates shoddiness in philosophy because it is an exalted activity will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water.[11]

How can educators meet that great range of individual differences among students, whether rich or poor, able or disabled, university-bound or destined for community college, apprenticeship, military, or a specific job including homemaking? We must vigorously challenge the assumption that a college baccalaureate degree is the sole road to excellence, respect, and dignity. We cannot allow ourselves to confuse social and educational status with equality of opportunity and individual achievement, regardless of the field of study.

It will be a sad day indeed if the "excellence movement" in education becomes a cover for a retreat from equity and opportunity concerns. As stated by the Commission on Pre-College Education in Mathematics, Science and Technology, "excellence and elitism are not synonymous."[12]

Clearly, American education requires one or two new definitions of excellence in education—definitions that will hold meaning for all students.

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11. Gardner, *Excellence*.

12. William Coleman et al., *Educating Americans for the 21st Century*, National Science Board Commission on Pre-College Education in Mathematics, Science, and Technology (Washington, D.C.: Government Printing Office, 1983).

Trend analysts, forecasters, policy makers, and strategic planners are all finding dramatic ways to underscore what we have already begun to understand in a visceral way. The twenty-first century, sped by technological advance, will present a richer, more complex reality in which an increasing number of our citizens will want and need more of life and work. In that context, education faces some imposing challenges, particularly in helping students develop the competencies and the proficiencies required to successfully, even joyfully, cope with the dilemmas of a rapidly changing world.

Is imposing classical-education, baccalaureate-degree goals upon all students the answer to these new challenges? Obviously not. Such a program may indeed motivate some students, but surely it will discourage others—especially the three out of four high-school graduates who are not likely to complete a college baccalaureate-degree program. Can these students also experience educational excellence? The answer is yes—but they need more than high-school "bachelor living," "arts and crafts," and other hobby-type courses.

Some fundamental shifts must be made in school and college programs if the needs of all students are to be met and the universal education enterprise is to be moved up the road a few more miles. High schools and community, technical, and junior colleges must be concerned with improving the educational program and performance of all students . . . along with the baccalaureate-bound student.

NEEDED: A TECH PREP/ASSOCIATE DEGREE CURRICULUM

What is the answer to all these undeniable needs? First, high schools would do well to eliminate the unfocused general education program and replace it with a Tech Prep/Associate Degree (TPAD) applied-academics program to work alongside the college prep/baccalaureate degree program and the high-school diploma/vocational education program. It means adding a third leg to the educational stool.

TPAD programs target the two middle quartiles of the typical high-school student body in terms of academic talents, learning styles, and interest. They emphasize preparation for the middle range of occupations requiring some postsecondary education and training, but not necessarily a baccalaureate degree. Of the twenty fastest-growing occupations in the decade of the 1990s—nursing, computer science, law enforcement, office-machine service and repair, engineering technician, banking, and insurance—all will require some form of postsecondary education and training, but only two of these occupations will require college baccalaureate degrees for entry.

Applied academics are foundational to any TPAD program. The current nationwide 27-percent high-school dropout rate can be reduced if students understand the "why"—the application of their learning—as well as the "what"—the knowledge itself. This means breaking down the walls between vocational education and academic education and developing a substantive applied-academics program. The largest volume of high-school dropouts occurs between grades ten and eleven. This volume can be reduced if students see a focused and respected alternative learning opportunity that connects high-school and college curricula with real-life issues . . . the context for learning.

The 2+2 and 4+2 TPAD programs described in this book combine a common core or foundation of applied academics (math, science, and communications) with the specifics of advanced-skill technical education. Beginning with the junior year in high school, students could select the TPAD major (even as they now select the college prep or the high-school diploma/vocational education major), and continue for four years in a structured and closely coordinated program, first in high school and then in community or technical college. They end up with an advanced-skills associate degree that prepares them for entry into a whole host of new jobs.

The TPAD program advocates taking a step beyond the current and usually cosmetic high-school/college partnership arrangements into substantive curricular coordination. The TPAD program seeks a middle ground that blends the liberal arts with the practical arts. Furthermore, a closely coordinated four-year (grades eleven through fourteen) applied-academics program will provide more room for an electives program than can be achieved in four unconnected years in different institutions.

The development of TPAD programs, which emphasizes five "Cs"—

- Continuity in learning,
- Context-based teaching (applied academics),
- Competency-based teaching,
- Communication between learning institutions (especially between high schools and postsecondary institutions), and
- Completion of the program with an associate degree—

offers students another definition of educational excellence. It is true curricular reform.

Continuity in learning
Context-based teaching
Competency-based teaching
Communication between educational institutions
Completion of the program with an associate degree

Figure 4: The Five Cs of TPAD Education

The TPAD program does not envision taking students out of high school. Rather, TPAD encourages students to stay in high school. They are taught by high-school teachers in the first two years, but must also have access to college personnel and facilities when appropriate. Starting with a solid base of applied sciences, applied math, applied communications, and technical education systems approaches, the high-school portion of the career program is intentionally preparatory in nature. Built around career clusters and technical-systems study, the TPAD approach helps high-school students develop broad-based competence in a career field and avoids the pitfalls of more short-term and narrowly delineated job training. It is the high school's responsibility to open up the world for the high-school student rather than close it down through narrow and specific job training.

The high school (or vocational school) TPAD program must dovetail with specific technical education programs on the postsecondary level. More intense technical specialization is developed at the college level, always in tandem with broad technical competence and broad academic competence aimed at working in a "wide-technology" society.

It is anticipated that one result of this program will be a better understanding of the associate degree as it becomes a preferred degree for employers seeking to fill a broad range of mid-level occupations. As a result of increasing employer demand, many students are now seeking the associate degree as a preferred career development goal. Nearly half a million of these degrees were awarded in 1989, and the trend is upward. The TPAD program aims at packing the best education and most flexibility possible into the associate degree in order to provide employers with competent workers and students with a bright future.

Obviously, developing and implementing such a closely coordinated program requires that high-school, vocational/technical-school, and community college administrators and faculty talk regularly—both with each other and with employers. It demands mutual respect and cooperation every step of the way. Such cooperation and mutual effort cannot help but have a positive effect not only on students, but on the community as a whole.

The TPAD concept provides a dramatic model for educators wishing to avoid slippage and loss of continuity in bringing program structure and substance to nonbaccalaureate degree students. And already the program is working: many high-school/college partnerships are being developed. Here is what school superintendent Douglas James, of Richmond, North Carolina has to say about the program:

> First, I would have to say that the program has had the greatest impact on secondary education in Richmond County since high school consolidation in 1971. Previous to Tech Prep, 25 percent of our high school students were enrolled in our pre-college program and 75 percent in the general academic/vocational curriculum. Now, over 30 percent are enrolled in the pre-college curriculum and another 30 percent in our Tech Prep program, which involves a more rigorous academic and technological course of study.
>
> Enrollment in Algebra I has increased 42 percent over our 1985-86 enrollment, with an associated increase in our average end-of-course test scores. Algebra II enrollment has increased 57 percent, with a slight decrease in average end-of-course test scores. A significant increase has also been experienced in student enrollment in more advanced English, social studies, and science courses. . . . Since the beginning of our Tech Prep program, our average SAT score has increased 46 points, the dropout rate declined . . . and the percentage of graduates choosing to attend a community college increased from 24 percent to 46 percent.[13]

EVERYBODY WINS!

Who wins and who loses in the development of the TPAD program? There are no losers . . . only winners.

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[13] Personal letter from Douglas James to Dale Parnell in 1988.

Students will develop sound basic skills and knowledge while obtaining a first-rate technical education. They will develop the competence to be able to cope with a fast-changing modern life . . . and do that with confidence. *Students will be the big winners!*

Employers will win by obtaining a better-educated worker than ever before. And skilled-worker shortages will be alleviated as the TPAD program becomes widely operational across the country in high schools and colleges.

High schools will win because more students will stay in school to complete their high-school education, and more students will find satisfaction in their courses of study. The tone and morale of the high school will improve as more students find themselves engaged in a purposeful and substantial educational program.

Colleges of all kinds will win because entering students will be better prepared. Because colleges will spend less on remedial and developmental education programs, they will be able to spend more on increasingly sophisticated technical programs. In addition, colleges will be able to meet the needs of more students better.

Communities and states will win because cooperation at different levels of education will eliminate program duplication, provide for greater efficiency, and more fully develop the human resources of each region.

Finally, *America* will certainly win by the development of a world-class work force that will outwork, outproduce, and outsmart the competition. The greatest resource in our nation, the human resource, will be more fully developed than ever in our history. The remainder of this book is dedicated to helping policy makers and educators understand how to make this winning proposition a reality.

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2

GETTING OFF THE GROUND

The Basics of Developing a TPAD Consortium

Dan Hull

"Good TPAD programs are not going to evolve by simply redefining (redrafting) what we're already doing, maintaining horizontal and vertical barriers between isolated sectors of the educational process, and hoping that the American employers will be satisfied with what educators think is best for the students and the new labels that are applied to them. A new synergism must be developed at the local and state levels—to make significant and appropriate changes in curriculum, cooperation, and coordination."

2

Articulation in education—placing emphasis upon continuity of learning from one level of education to another—has been discussed and practiced in one form or another for many years. Two-plus-two programs, which coordinate curricula between secondary schools and higher education, also have been around for quite a while. But relatively new is the concept of a "tech prep" high-school component leading to completion of an associate degree in a community or technical college. This idea was introduced in 1985 by Dale Parnell in his book, *The Neglected Majority*.

Since that time, many high schools and colleges across the nation have made conscientious efforts to develop Tech Prep/Associate Degree programs. In fact, such programs have become the cornerstone of the Carl D. Perkins Vocational and Applied Technology Act,[1] which funds vocational-technical education programs. Proven tools (curricula, instructional resources) and techniques for implementing Tech Prep/Associate Degree programs are now emerging; the roles and attitudes of educators, who are key to the process, are being better understood; and employers are reaching consensus about the qualifications of the "new American work force" to be prepared by TPAD programs.

The introduction of TPAD programs—with their new approach to educational structures and curricula—is being cited as one of the few real educational reforms for working people. A national movement implementing the Tech Prep/Associate Degree curriculum is well under way. In five years we should know whether the changes are lasting or another fad in education has passed.

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[1] Originally the Carl D. Perkins Vocational Education Act, amended as the Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990.

This chapter will attempt to provide consistent and comprehensive definitions of the various terms and labels in articulation. It will provide a rationale and show the need for a Tech Prep/Associate Degree program based on experience in technical education. In addition, it will suggest goals for such a program, identify the roles and responsibilities of those involved in instituting it, and lay down a basic development process that can be modified or adapted for a particular state or consortium of schools and colleges.

APPLIED ACADEMICS AS A FOUNDATION FOR TECHNICAL CAREERS

In the early 1980s, when the need for reform in public education became apparent, vocational and technical education was also examined (internally and externally) and found to require significant structural changes. Vocational education, particularly as practiced in secondary schools, was operating on a model that for years had met valid needs. Refinements had occurred in areas such as competency-based curricula, individualized instruction, and use of occupational advisory committees. In some instances, modern equipment and laboratories had been installed. But in 1980, vocational education still concentrated mostly on teaching about tools and techniques, and competency-based education meant "teaching the specific task."

This approach was generally responsive to employers' stated needs for various industrial workers and the interest and abilities of students taking a concentration of high-school vocational courses. In the 1950s, 1960s, and 1970s, tools and techniques didn't change very quickly, and workers found that they had time to adapt to the slow changes. Moreover, industry's requirements for "front line" workers called for compliance, ability to follow instructions, and accomplishment of repetitive tasks in a very structured work environment.

Many students entered vocational education programs with poor academic skills and, unfortunately, left with poor academic skills. These students generally found the "hands-on" approach to education and training appealing and developed better self-confidence while involved in voc-ed programs. Many stayed in school because of vocational education and emerged as good entry-level workers for a variety of jobs. But few achieved the academic foundation that they lacked and needed in a fast-changing technological society. Consequently, "retraining" for them usually became a matter of teaching different tools and new techniques, not a catalyst for career advancement. By 1980, many vocationally trained workers found themselves either at a "dead end" in their career or out of date with current practices—and unable to adapt to the rapid changes in the workplace.

During this same period, changes were attempted in community, technical, and junior colleges to upgrade the image of technical education away from the traditional and time-honored "trade school" vocational training practices toward more sophisticated technical education. Where rigorous technical education programs were attempted, educators found it necessary to "water down" the analytical and scientific content to accommodate entering students with poor academic skills—or risk high dropout rates and low enrollments. Too often, postsecondary technical education courses provided outdated equipment and limited laboratory experiences. Exceptions to these models described above did exist, but they were rare.

Rethinking the Structure of Vocational Education

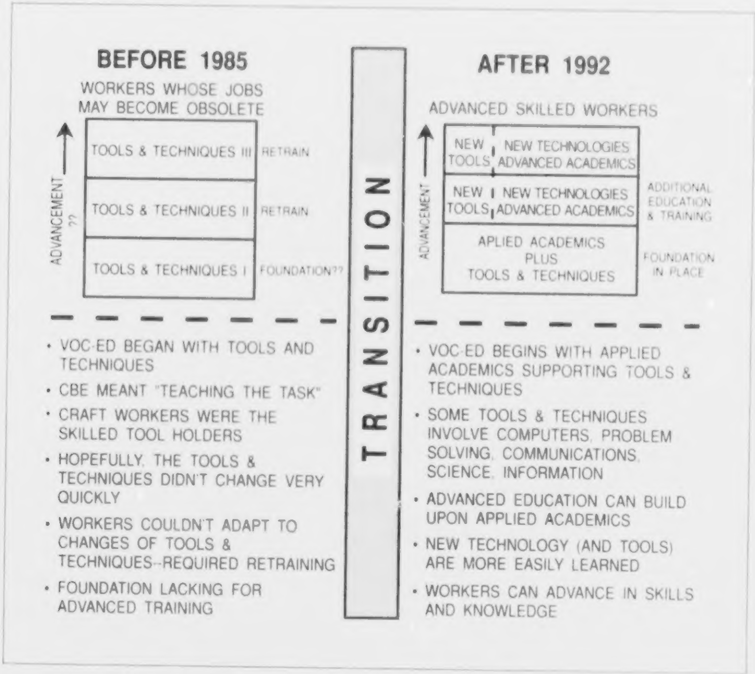
Clearly, it was time to rethink the structure of vocational education to meet the changing needs of both students and marketplace. And educators began to respond. By 1985, pilot sites in thirty-five states were testing an applied-science course (Principles of Technology) for high-school students enrolled in vocational education. In other places, attempts were made to infuse academics (math, science, communications) into vocational courses.

The success of these and other efforts (discussed in chapter 3 and appendix C) showed that most students in high-school vocational programs could learn academically rigorous science and math if these subjects were taught in a hands-on setting and if subject matter was presented in the context of how it is used in personal, societal, and work-based situations. Accordingly, vocational leadership in forty-eight states worked to foster development of applied-academics curricula, primarily for students in the "forgotten half" of the high-school population who do not necessarily aspire to a baccalaureate degree at a university.

The applied academic curricular materials developed to date include:

- Principles of Technology (Applied Physics)—two years,
- Applied Mathematics—two years,
- Applied Communication—one year,
- Applied Biology/Chemistry—one year.

Thus, a significant transition in vocational and technical education took place, as shown in figure 1. By the early 1990s, it will become both possible and practical to provide a career-oriented educational curriculum that helps high-school students acquire an applied-academics foundation relevant to the tools and techniques of a particular technical field, then continue on to earn an associate degree in that same field from a postsecondary institution. Such a program gives workers the education and training necessary for them to advance in their jobs and adapt to new technology. The theme of such a program could be summarized as "*Build a Foundation; Build on the Foundation.*"



- VOC-ED BEGAN WITH TOOLS AND TECHNIQUES
- CBE MEANT "TEACHING THE TASK"
- CRAFT WORKERS WERE THE SKILLED TOOL HOLDERS
- HOPEFULLY, THE TOOLS & TECHNIQUES DIDN'T CHANGE VERY QUICKLY
- WORKERS COULDN'T ADAPT TO CHANGES OF TOOLS & TECHNIQUES--REQUIRED RETRAINING
- FOUNDATION LACKING FOR ADVANCED TRAINING

- VOC-ED BEGINS WITH APPLIED ACADEMICS SUPPORTING TOOLS & TECHNIQUES
- SOME TOOLS & TECHNIQUES INVOLVE COMPUTERS, PROBLEM SOLVING, COMMUNICATIONS, SCIENCE, INFORMATION
- ADVANCED EDUCATION CAN BUILD UPON APPLIED ACADEMICS
- NEW TECHNOLOGY (AND TOOLS) ARE MORE EASILY LEARNED
- WORKERS CAN ADVANCE IN SKILLS AND KNOWLEDGE

Figure 1: Rethinking the Structure of Vocational Education

The Education and Training of Engineering Technicians: A Model for TPAD

Educators looking to update their technical education programs were able to draw on the foundation of a program developed from

1970 to 1983 by the staff of the Center for Occupational Research and Development (CORD). CORD specialized in developing curricula and providing assistance to community and technical colleges in implementing two-year programs for engineering technicians in new and emerging technologies.[2]

Advanced-technology curricula developed during this period included computers, telecommunications, laser/electro-optics, nuclear safety, power-plant operations, nondestructive testing, quality control, computer-aided design, instrumentation and control, robotics/automated manufacturing, environmental/chemical process control, and maintenance of equipment in intelligent buildings.

In the late 1970s and early 1980s, changes in technology and industry's requirements for technicians called for significant curriculum changes to emphasize:

- *a stronger math/science foundation* (better "knowledge skills," the ability to solve problems, and the ability to learn new technology in a rapidly changing field),
- *use of computers* (for design, information management, and control of machines such as robots),
- *combinations of skills* (interdisciplinary approaches such as electrical-mechanical-fluid-thermal-optical systems), and
- *interpersonal/communication skills* (team building, customer relations, presentations, and just "getting along with other workers" at all levels).

More specifically, new technologies called for new competencies. Increasingly, engineering-technician jobs required that the graduate of an advanced-skills program be able to:

- use basic principles, concepts, and the laws of physics and technology in practical applications.
- use algebra, trigonometry, and analytic geometry as problem-solving tools. (An understanding of higher mathematics—including computer language and some calculus—may be required.)
- analyze, troubleshoot, and repair systems composed of subsystems in three or more of the following areas: electronic, electrical, mechanical, thermal, hydraulic/pneumatic, optical.

2. An engineering technician is one who builds, modifies, installs, maintains, repairs, and calibrates modern equipment, systems, and processes in manufacturing plants, modern buildings, hospitals and offices, power-generating plants, transportation systems, processing plants, and communications systems.

- use materials, processes, apparatus, procedures, equipment, methods, and techniques common to technology.
- apply detailed knowledge in one field of specialization with an understanding of applications and industrial processes in that field.
- use computers for information management, equipment and process control, and design.
- record, analyze, interpret, synthesize, and transmit facts and ideas with objectivity—and communicate information effectively by oral, written, and graphical means.[3]

In the early 1970s, most two-year programs in engineering technology were traditionally classified and related to baccalaureate engineering programs—electrical engineering, mechanical engineering, civil engineering, and so on. In 1980, based on the demand for new skills and competencies, CORD chose to reorganize its engineering-technology curricula. A "common core" curriculum was designed that would serve a cluster of more specific engineering occupations. This core curriculum, shown graphically in figure 2, consists of a Basic Skills area containing math, science (primarily physics)[4], communications (reading, writing, listening, speaking), computer use, economics, and interpersonal (social) skills and a Technical Core Area, providing an electromechanical foundation plus electronics, materials, controls, and graphics. It would then be combined with a Specialty Area containing courses in a chosen field of engineering.

The core-curriculum model was adapted and implemented in community, technical, and junior colleges throughout the country as a foundation for advanced-skills training in up to eight or ten major engineering fields. Over six hundred employer representatives on numerous fifteen- to twenty-person advisory committees confirmed the validity of this curriculum approach.

[3] This list of competencies was derived by summarizing task listings from twelve different technician categories.

[4] Five technologies emerging in the 1990s are advanced materials technology, semiconductor manufacturing, hazardous materials, biotechnology, and environmental restoration. These fields call for a new core that includes a foundation in chemistry and biology as well as physics.

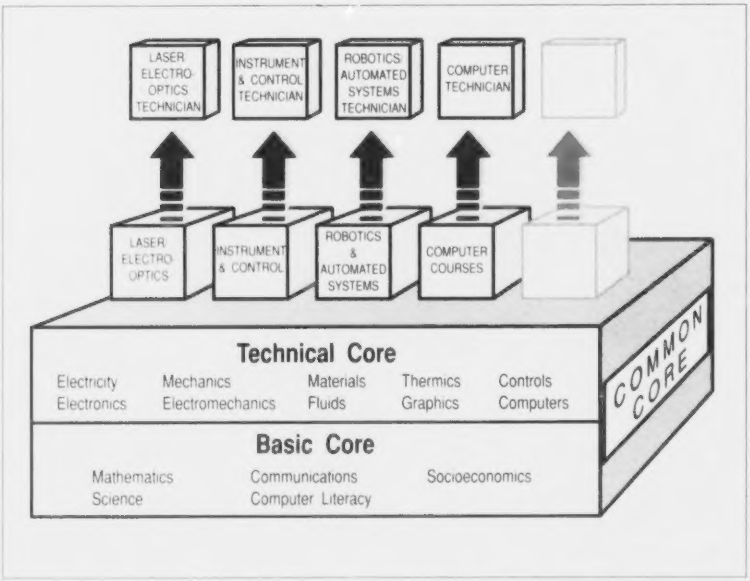


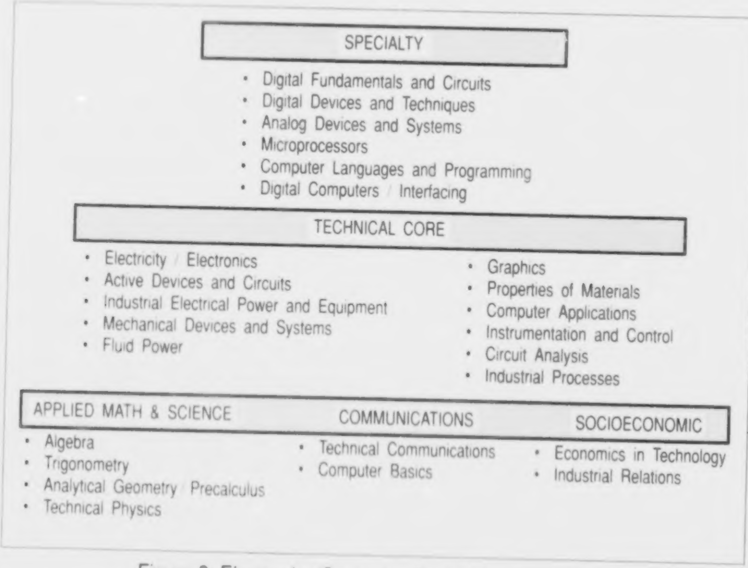
Figure 2: Advanced-Technology Curriculum Structure

The Need for Better-Prepared High-School Students

Unfortunately, community and technical college faculty members found it difficult to incorporate the required changes. Typical responses included

- "You can't teach a program like that in two years with the type of students we are getting."
- "The average student is not prepared to enter this program." (More than 80 percent of entering students—high-school graduates—require remediation in math, science, English.)
- "When they were in high school, 90 percent of our students did not know they would be coming here . . . and they didn't prepare."

These experiences persuaded the CORD staff that the advanced-skills programs for engineering technicians, as identified by large groups of employers, could not be fully realized in a two-year postsecondary program. In fact, the typical high-school student entering the kind of postsecondary technician program described in figure 3 required up to *three years* of concentrated study to complete the associate degree. It would be better, therefore, if preparation for such a program could begin in high school. Ideally, the first third of an advanced-skills curriculum should take place before a student enters the associate-degree program—and the content of that "first third" should come mostly from the common core which serves a cluster of occupational specialties. This "first third" of an advanced-skills associate degree program is what Parnell calls tech prep[5]—and "TPAD" refers to the coordination of tech prep with an advanced-skills associate-degree program.



SPECIALTY

- Digital Fundamentals and Circuits
- Digital Devices and Techniques
- Analog Devices and Systems
- Microprocessors
- Computer Languages and Programming
- Digital Computers / Interfacing

TECHNICAL CORE

- Electricity / Electronics
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Mechanical Devices and Systems
- Fluid Power
- Graphics
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Circuit Analysis
- Industrial Processes

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

Figure 3: Electronics/Computer-Technician Curriculum
(Model for Two-Year Postsecondary Technology Program)

CORD's discovery of the possibilities inherent in combining a high-school tech-prep program with an advanced-skills associate degree was based on its work in engineering-technology programs. But similar preparation is needed today in a wide variety of occupational clusters, including health care, electrical/mechanical, business/marketing, agriculture/agribusiness, and certain craft and home-economics specialties. These fields represent career clusters especially appropriate for those high-school students typically identified as "general-education students."

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[5] Dale Parnell, *The Neglected Majority* (Washington, D.C.: Community College Press, 1985).

In a typical high school, about one-third of the students are seriously preparing to enter baccalaureate programs at colleges or universities. Their program of study, often known as college prep/baccalaureate degree, prepares individuals for professional or semiprofessional careers.

As shown in figure 4, another one-fourth of the students, because of either interest or need, will complete their formal education before or at graduation from high school and immediately enter the work force. This group needs a well-designed, appropriately structured vocational-education program with as much emphasis on applied academics as possible. It is likely that, in the future, more sophisticated vocational education and training, along with better planned school-to-work transition programs, will be available to reduce the high-school dropout rate and the number of low-skilled youth and adults on the job market.

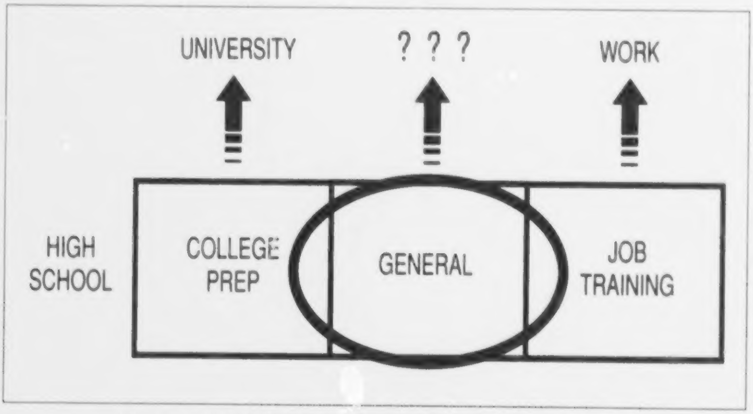

Figure 4: Who's the Target Population for 2+2 Articulation?

The remaining 40 percent of high-school youth across the nation are enrolled in an unfocused program usually called general education. Most often, unfortunately, this curriculum fails either to engage students' interest or to provide them adequately for either the work force or ongoing education. Studies have shown that students in this group are:

- underachieving in school in proportion to their abilities,
- generally disinterested in classwork, taking the easiest courses possible,

- most likely to drop out,
- least prepared for a job, and
- most likely to eventually show up at a community or technical college (whether at age nineteen or at age forty-nine)—underprepared and often requesting admission to a technical education program.

The present plight of this group is an embarrassment to public education and represents a shortfall in the commitment of American society to help its people be all they can be. But this group also represents an untapped potential for enabling our country to regain its competitive edge in world markets.

The high-school general-education student in the United States is the primary target population for the Tech Prep/Associate Degree program. The general-education segment of the high-school population contains nearly half of our future work force; it includes many bright but low-achieving students who have the potential to become tomorrow's advanced-skills technicians. It represents the two middle quartiles of a typical high school, or the "average" student—and, in America, average should not mean "half bad"!

Many of these students have been turned off by their high-school program because they do not learn well in the abstract—that is, they are "hands-on learners." Applied academics (described in chapter 3) have been shown to be understandable, achievable, and attractive for hands-on learners. An articulated program between high schools and college associate-degree programs that provides a strong foundation in applied academics, therefore, can do a lot toward tapping the potential of this important segments of America's future.

HOW MANY WAYS CAN YOU SPELL ARTICULATION?

Articulation can be broadly defined as a process for linking of two or more educational systems within a community to help students make a smooth transition from one level to another without experiencing delays, duplication of courses, or loss of credit. One of the clearest, most comprehensive, most meaningful descriptions of articulation was written over a decade ago. It describes articulation as a process, an attitude, and a goal:

> As a *process*, articulation is the coordination of policies and practices among sectors of the education system to produce a smooth flow of students from one sector to another. As an *attitude*, it is exemplified by the willingness of educators in all sectors to work together to transcend the individual and

institutional self-interest that impedes the maximum development of the student. As a *goal*, it is the creation of an educational system without artificial divisions, so that the whole educational period becomes one unbroken flow, which varies in speed for each individual, and which eliminates loss of credit, delays and unnecessary duplication of effort."

The Articulation Umbrella of Terms and Labels

Covered under the umbrella of articulation are the numerous (sometimes confusing) labels, including vertical articulation, horizontal articulation, 2+2, 2+1, 4+2, 2+2+2 and Tech Prep/Associate Degree program (see figure 5).

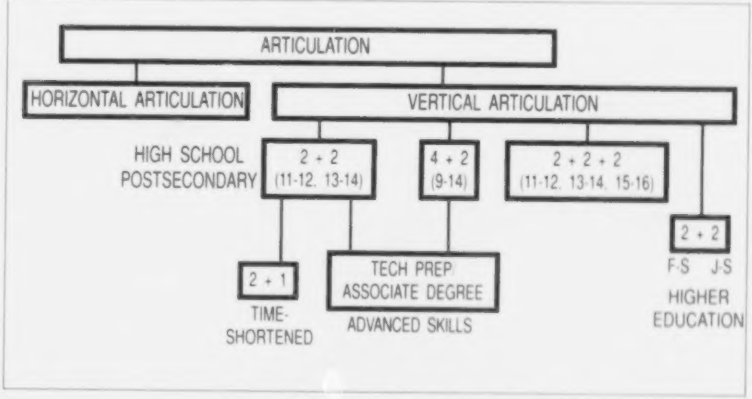

Figure 5: The Articulation Umbrella

Horizontal articulation generally refers to student transfer of credit from one program to another within an institution or from one institution to another at the same level.

Vertical articulation refers to the transfer of credit from a lower-level institution to a higher-level one. The term is used both in higher education and in a secondary/postsecondary connection. The higher-education version of vertical articulation (which is referred to as 2+2) describes a junior-college/senior-college connection.

The remainder of the terms—including the more common use of 2+2—refer to articulation between high school and postsecondary

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6. W. Henry Con and James Hardy, "School University Network: Toward a Model of Articulation," *North Carolina Association Quarterly*, 1978.

(community and technical college) institutions. For the purposes of this book, unless otherwise designated, 2+2 is used to refer to the high-school/postsecondary form of vertical articulation.

A useful definition of a 2+2 program was developed in 1989 by the Texas 2+2 Model Projects Users Group:

> Two-plus-two programs are articulated, competency-based, technical-vocational curricula jointly designed by business, secondary, and postsecondary institutions linking the last two years of secondary education with the first two years of postsecondary education to produce a strong curriculum containing competencies not possible to achieve in only two years.

Unfortunately, many early attempts at developing 2+2 articulated programs have not reached the standards set forth in this definition. Some arrangements simply matched existing courses in high schools and postsecondary schools that had similar content and transferred credit between. Others were not competency-based, that is, determined from examination of job/task requirements developed in cooperation with future employers.

Most of the 2+2 articulated programs that have been developed to date do represent an earnest attempt to interest general-education students in technical-education programs, eliminate redundant course work, and provide a smooth transition from one institution to another. It's a commendable beginning—and may be the only way some consortia can begin the process— but it's not a final goal and should provide no more than temporary satisfaction for the educators who are involved.

In 1988 and 1989, Maureen Ramer conducted the Rio Hondo study on "Consensual Definition of 2+2 Programs", using a Delphi technique with eight panelists (six in California, two outside). Figure 6 summarizes the areas of consensus achieved in this study.

In 1986, researchers at the National Center for Research in Vocational Education[7] studied articulated programs at twenty operating sites throughout the United States. They concluded that most 2+2 secondary/postsecondary articulated programs could be classified into two categories:

- advanced-placement (time-shortened) programs, which
  — eliminate unnecessary redundancy,

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[7] James P. Long, Catharine P. Warmbrod, Constance R. Faddis, and Max J. Lerner, *Avenues for Articulation*, (Columbus OH: National Center for Research in Vocational Education, Ohio State University, 1986).

  - — grant advanced placement in postsecondary programs, and
  - — allow students to complete postsecondary program in less time, and
- advanced skills programs, which
  - — also eliminate unnecessary redundancy,
  - — add more advanced training (high-technology emphasis), and
  - — allow students to complete postsecondary programs with higher-level skills.

PURPOSE

The purpose of a 2+2 program is to eliminate unnecessary duplication of coursework, thus offering time-shortened curricula and a smother transition from one educational level to the next.

PARTICIPANTS

The essential participants in 2+2 programs in California are the community college, high school, and ROC/P (Regional Occupational Center/Program).

2+2 programs are developed jointly by administrators and faculty of participating agencies.

CRITERIA FOR DEVELOPMENT

2+2 programs should be developed in an occupation for which the demand for employment is substantiated and the knowledge and skills are greater than can be met in a high-school, ROC/P, or community-college program alone.

CURRICULUM

The curriculum requirements for a 2+2 program should include technical skills, written and oral communications, mathematics, interpersonal skills, science (when appropriate), and job-search skills.

COLLEGE CREDIT

Students completing the high-school or ROC/P-level courses of a 2+2 program may receive college credit for that work as long as the basic skill competency requirements for the equivalent college courses have been satisfied.

Students who earn college credit for high-school or ROC/P-level courses within a formal articulation program may apply those credits toward the major in the 2+2 program.

LENGTH OF PROGRAM

The length of time needed by a full-time student to complete the 2+2 curriculum depends on the nature of the program.

PROGRAM AWARD

The student completing a 2+2 program receives an associate degree or certificate of achievement depending on the nature of the program.

Figure 6: Consensual Definition of 2+2 Programs: Rio Hondo Study[8]

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8. Maureen Ramer, *Community College/High School Vocational Articulation in California: 2+2 Program Definition and Barriers to Implementation* (Ph.D. diss. Pepperdine University, 1990).

Other terms used in describing vertical articulation programs are 4+2, 2+2+2 and 2+1. The focus of this book is upon grades eleven, twelve, thirteen, and fourteen. But it must be emphasized that a basic foundation for the TPAD program must be developed in grades K through ten (see diagram at beginning of preface).

The first of these terms, 4+2, refers to an articulated program in which a course of applied academics designed to lead to an associate degree begins in grade nine. Such a program provides students with maximum flexibility and greater ability to "switch programs" later in their secondary-school careers.

The second, 2+2+2, refers to coordination of the last two years of a high-school program (grades eleven and twelve) with a two-year postsecondary associate degree program and two additional years—possibly the last two years of a four-year baccalaureate-degree program.

The third, 2+1, describes a time-shortened 2+2 program whereby a student earns enough advanced credit in high school to finish an associate degree with one additional year at the postsecondary institution.

Redefining Tech Prep

The Tech Prep/Associate Degree program is the technical-education alternative to the time-honored college prep/baccalaureate degree program. Tech prep is targeted for—but not limited to—"general education" high-school students (the forgotten half) who think, reason, and learn much better in concrete terms than in the abstract mode as presented in most liberal arts programs. Thus, TPAD rests on the foundation of applied academics—incorporating real-life applications and hands-on experience into the teaching of academic subjects. Applied academics is *not* "watered down" learning; it simply takes into account that the majority of students learn best by concrete applications, which let them see the clear context for their learning. The theme of applied academics, therefore, can be summarized as: *"It's Not Easy; It's Just Easier to Learn."*

A Tech Prep/Associate Degree program is a carefully designed curriculum that engages a high-school student in a four-year (2+2) or six-year (4+2) plan to gain the competencies (knowledge, skills, and values) required for technical careers. TPAD meets the human needs of a large group of Americans who deserve a first-class public education tailored to their interests and abilities. It also serves the economic needs of this nation's businesses and industries by providing advanced-skilled workers who can participate in new, high-performance work organizations that are keyed to productivity improvement, high wages, and economic competitiveness in a global marketplace.

The Commission on the Skills of the American Work Force, in their report, *America's Choice: High Skills or Low Wages!*, recommends that "a comprehensive system of technical and professional education certifications and associate degrees should be created for the majority of our students and adult workers who do not pursue a baccalaureate degree."

Applied academics in general and TPAD programs in particular are timely, effective responses to this recommendation. The high school/postsecondary approach to providing the "comprehensive system" recommended is a 2+2 articulated program spanning grades eleven through fourteen or a 4+2 program introducing applied academics at grade nine. (Such a 4+2 program provides maximum flexibility.)

It is possible, of course, to articulate *any* curriculum between secondary and postsecondary institutions—including social studies, English, or foreign languages—and it is good to do so. For a curriculum to qualify as TPAD, however, it should:

- run parallel to—not replace—college prep/baccalaureate degree programs,
- build an advanced-skills technical education on a common foundation of math, science, communications, and social sciences,
- lead to an associate degree or two-year certificate,
- incorporate relevant (real-life) applications of what is being taught—in other words, be built around applied academics,
- use a competency-based core curriculum structured around a career cluster of occupations, and
- provide employable skills at the conclusion of the high-school portion, so that, if circumstances require, students can work while completing their associate degree

Tech Prep for Adults

Eighty percent of the people who will make up America's work force in the year 2000 are already adults and therefore unlikely to participate in a high-school/postsecondary TPAD program. Yet many of the "front line" workers in the United States will face the same work-force situations that argue for a TPAD education: unemployment and the need for retraining due to job obsolescence, job changes, or needed career shifts. Many of these people also have inadequate academic records and lack the confidence to reenter formal educational or training programs that currently lead to good jobs and lasting careers.

Since 1987, however, several applied-academics-based education and training programs have been designed and delivered to adult displaced workers. These programs have been remarkably successful in (1) placing many back into jobs and (2) helping many of these earn associate degrees. These "transformations" programs have similar goals and curriculum structures to the high-school/postsecondary TPAD model—and thus have been labeled "Tech Prep for Adults." They are described in chapter 7.

DEVELOPING A TECH PREP/ASSOCIATE DEGREE CONSORTIUM

I'm a transformed engineer who has learned that people are as important in making things work as the design, machinery, techniques, rules, schedules and efficiency of the engineering process. This revelation is particularly appropriate in regard to developing a Tech Prep/Associate Degree program.

This is supposed to be the "how to do it" chapter of a "how to do it" book. But if the advice and direction provided here are confined to the tasks and the products of developing a Tech Prep/Associate Degree curriculum, both book and chapter will be less than half complete.

Changes in instructional content, strategies for teaching and learning, and expectations of the student are vital elements for reshaping the important and growing technician sector of the American work force. But equally important are attitudes and willingness to cooperate for a win-win experience among students, parents, teachers, administrators, counselors, and employers. Good TPAD programs are not going to evolve by simply redefining (redrafting) what we're already doing, maintaining horizontal and vertical barriers between isolated sectors of the educational process, and hoping that the American employers will be satisfied with what educators think is best for the students and the new labels that are applied to them. A new synergism must be developed at the local and state levels—to make significant and appropriate changes in curriculum, cooperation, and coordination.

What Is a TPAD Consortium?

A Tech Prep/Associate Degree consortium is a local organization of individuals and entities that have the ability, the time, and the desire to make significant changes in the local education system—changes which could improve the educational and career opportunities of many students and provide employers with a world-class work force of advanced-skilled technicians.

The entities in a TPAD consortium include at least one postsecondary institution such as a community, technical, or junior college; one or more high schools and/or area vocational-skills centers; several employers who may hire the technicians; and civic, parent, or economic-development groups. Individual representatives include the chief executive officers of all institutions involved; representative administrators, faculty, and counselors from the schools; and ranking officials from the employer and civic groups. Last, but not least, is the TPAD Coordinator, usually a staff person from the college or high school. This crucial position will require a person with good organizational abilities and people skills, an understanding of the TPAD process and goals, adequate and timely support from policy makers and CEOs, and full allocation of time to the consortium for at least one year.

(The responsibilities of each TPAD-consortium representative are outlined in chapter 4, "Putting the Committees to Work." Some indication about their attitudes and expectations for the process is provided in chapter 8, "How Do You Feel About TPAD?")

A TPAD consortium will need to allocate a budget which provides:

- Coordinator,
- clerical support for coordinator and for committees,
- travel and attendance at several state and regional workshops,
- visits to at least two successful TPAD programs,
- materials and supplies,
- at least ten days of paid time for all participating faculty and counselors (curriculum/guidance materials preparation),
- support (space and food) for three large and ten small meetings,
- development of student/counselor handbook,
- development of promotional/recruitment material,
- development of a ten-to-twelve-minute promotional/recruitment video,
- news releases and newspaper ads, and
- consultants (for technical content or evaluation) if needed.

Who Makes TPAD Work?

A TPAD consortium must start with a policy demand upon the educational system—an issuing of public and/or educational-system policy that demands development of a TPAD program. This can take the form of a directive from a state legislature, supplemented by policy statements issued by local school and college boards. The policy demand is then followed by administrative action creating a TPAD consortium.

Although the key individuals involved in a TPAD consortium could number as many as forty or fifty, the consortium as a whole probably would not need to meet together more than three or four times during the development process. Instead, each individual would serve on one or more of the following committees or working groups:

1. *Leadership Committee.* This group would consist of the CEOs of the cooperating institutions and industry representatives. Theirs would be the overall responsibility for the consortium's work and the final decisions about implementation.

2. *Implementation Committee.* This committee, made up of institutional administrators and community and state representatives, would decide questions of authority, work out joint agreements, and address issues of accreditation and remuneration.

3. *Curriculum Development Committee.* This group consists of employers and faculty of cooperating institutions plus curriculum specialists. Their job is to develop the plan and work out the details.

4. *Information/Promotion Committee.* Counselors, public information specialists, and community leaders make up this committee. They market the program and work to prepare and disseminate information about tech prep for students, parents, staff, community, and employers.

5. *Evaluation Committee.* This important group, comprised of unbiased representatives from secondary and postsecondary institutions and employers, monitors progress of program development, determines if process and curriculum are working, suggests ways for improvement, and reports back to the policy makers about progress.

Details on composition of committees, individual assignments, suggested schedules for meeting, and issues confronting each committee are provided in chapter 4 under the heading, "Putting Committees to Work."

Choices to Be Made

In planning a TPAD consortium, it is important to determine at a very early stage the magnitude of effort that the CEOs and administrators are willing to commit for their institutions. They must first understand what is involved with articulating courses, realigning course content to match, providing advanced placement for time-shortened programs, or providing a fully organized and operating TPAD program. And they must decide the level of articulation to which they aspire.

Three levels of attainment in a TPAD program are possible:

- *Level 1*, evaluating and rearranging the content of existing courses,
- *Level 2*, modifying the content of selected courses to reflect the needs of an articulated program; adding and/or deleting selected courses, and
- *Level 3*, rewriting the entire curriculum.

The most effective TPAD programs usually involve this third level, a rewrite of the entire curriculum. This process will be described later in this chapter under the heading, "One Way to Do It."

Why are entire rewrites so often required? Possible reasons include the need to :

- develop a competency-based curriculum,
- install the applied-academics curriculum and teaching methods at the secondary level,
- design the secondary portion of the TPAD curriculum toward a career cluster instead of a narrow specialty,
- design the postsecondary math, science, and technical courses to ensure continuity in learning and accommodate students' accomplishments from the secondary curriculum, and
- provide additional advanced-technology courses and/or work experiences at the postsecondary level.

Depending on local circumstances, the development of a TPAD program may need to proceed in several steps, taking two or three years to achieve a fully articulated program. If this is the case, each of the three levels listed above can be considered a "step" in developing a full TPAD curriculum.

Among the questions that must be asked as plans for a 2+2 articulation program get underway are:

- Will the program be time-shortened or skill-enhanced?

- Will course comparisons be based on course outlines or student competencies?
- Will the articulated curricula incorporate a career ladder concept?
- Will applied academics be incorporated?
- Who will be the partners in the consortium (secondary, postsecondary, employers)?
- What resources are available?
- How will the TPAD program development be coordinated and monitored

A "career ladder" is a curriculum that incorporates a series of exit/re-entry points, each of which leads to a specific but progressively higher job classification. The competencies of each job level provide the foundation for the next level. An example of a career ladder is an articulated Allied Health curriculum (see page 175) which begins at the ninth grade and continues through the fourteenth grade. At the end of the twelfth grade (high-school graduation) a student would have gained the competency to become a nurse's aide. The student could re-enter (or continue) the curriculum and at the end of the thirteenth grade (freshman in a community college), the student would have the competency to become a licensed vocational nurse (LVN) or licensed practical nurse (LPN). The student could re-enter (or continue) the curriculum and at the end of the fourteenth year (sophomore in a community college) graduate with an associate degree in nursing and have the competencies to become a registered nurse (RN) and would also have the option of continuing to a university to obtain a baccalaureate degree in nursing (BSN).

Career ladders are not appropriate, of course, for all TPAD programs. They usually work best for skill-enhanced programs rather than time-shortened ones.

One Way to Do It (Laying Out the Process)

In the past several years, the CORD staff has served as a consultant for eight TPAD consortia, providing technical, planning, coordination, and catalyst services. The following schedule of tasks and comments is based on experience with these eight groups. Chapter 4 will develop in more detail how these tasks can be accomplished.

1. *Identify institutions that would benefit from articulated TPAD programs.* Many innovative high schools are now fully aware of the need to eliminate the general-education program. They are looking for realistic alternatives that are flexible enough to allow their students to

move into a college prep/baccalaureate degree major or a TPAD major if their interests and achievement change. If the high-school faculty is already making substantial use of applied-academics techniques and programs, they will find it easier to commit to tech prep.

Similarly, area vocational schools or regional skills centers are searching for ways to connect their programs to secondary and postsecondary curricula for students who choose to pursue advanced skills. Community, technical, and junior colleges need better-prepared students and more full-time students. They are also searching for ways to upgrade and provide a competency base for their associate-degree programs in order to support the economic-development goals of their communities.

2. *Identify advanced-level technical occupations that are suitable for the TPAD curriculum and garner the support of key employers.* TPAD's potential to provide advanced-skills employees with a stronger academic foundation should be presented to the leadership of key employers in the schools' service area, and their support or endorsement should be solicited. This could be done through one or a series of "feasibility" meetings in which at least one institutional CEO should participate. Such a "policy meeting" probably should not involve the usual advisory committee members, who are apt to lobby for the status quo. If an optimistic response is anticipated, press coverage should be considered. Once the commitment has been made, employer representatives should be designated for curriculum design/development efforts.

3. *Arrange for CEOs of participating institutions to agree on goals to be achieved through articulation and to execute a written statement of their intent to develop an articulated TPAD program (an Executive Articulation Agreement).* This effort may occur before or after step 2. The group should consider the concept options, the magnitude of the effort, the proposed budget, and the persons or roles that each entity must provide or fill—as well as deciding whether to move directly into a TPAD program or to proceed in steps, as discussed previously. A commitment of CEOs from all participating institutions is essential at this point.

When an agreement has been reached among participating institutions, the CEOs should draft and sign an Executive Articulation Agreement—a simple letter of commitment stating their intent to develop a Tech Prep/Associate Degree program in a specific occupational (cluster) area and specifying a date on which to begin the program. Those signing the agreement will make up the Leadership Committee.

4. *Meet with faculty, administrators, and counselors of all institutions to explain the program; appoint Implementation, Curriculum Development, Information/Promotion, and Evaluation Committees, and select the Coordinator.* As soon as the commitment from the institutional CEOs has been established, all participants in the planning process should be brought together for an explanation of the goals and process, an opportunity to respond with questions and concerns, and enlistment for specific assignments and responsibilities. (Chapter 4 will describe these responsibilities in more detail.) Some won't fully understand the plan or rationale, and some may resist the change, but it is important to get early involvement by all who will have a role in making the TPAD consortium a success.

5. *Determine job descriptions and competencies; design curriculum/course sequence accordingly.* Steps 5 and 6 incorporate all the careful research and design work that must be accomplished to produce a competency-based instructional program. Several iterative techniques and processes are available and have been used to develop excellent curricula. The same processes have been misused to produce poor and inadequate curricula. The following considerations may be helpful in avoiding typical pitfalls in competency-based curriculum design:

- Involve representatives from at least six potential employers to define the jobs and identify the tasks that newly educated/trained employees will be expected to perform. The majority of these representatives should be at least second-level managers to avoid listing only the "current skills" for entry-level employees.
- Aim the curriculum toward providing "advanced-skills" level employees to take full advantage of the TPAD potential. This approach may require that the employer representatives project the types of employees they will need *in the near future* rather than what they need at the moment.
- Search beyond the specific "tools and techniques" in job tasks to identify common knowledge components, people skills, problem-solving abilities, and foundations for learning new skills and cross-training.
- Design the early part of the course sequence (the core curriculum) to address the needs of a cluster of related occupations.

6. *Determine course objectives and necessary lab activities; establish proficiency levels for course objectives.* One key to a successful TPAD consortium is mutual trust among all parties. To establish this atmosphere of trust, several things must happen. Community, technical, and junior colleges must prove the quality of their programs to an accrediting body from the outset. Similarly, high schools who want their courses accepted for postsecondary credit must show the quality and integrity of their content and the successful accomplishment of course objectives. Establishing trust between the participating bodies eliminates the need for proficiency testing.

A competency-based curriculum will have well-defined course content, including stated performance objectives and clearly identified standards for measuring proficiency. When all parties agree on course objectives and proficiency standards, there should be no concern over when, where, and by whom the course is offered.

An example of proficiency standards developed for a competency-based curriculum is shown below:

4: Highly proficient: Can complete task quickly and accurately, can direct others in how to do task. Needs only normal supervision.

3: Competent: Can do all parts of the task. Needs only spot check of completed work. Meets minimum entry-level requirements. Needs job-entry supervision.

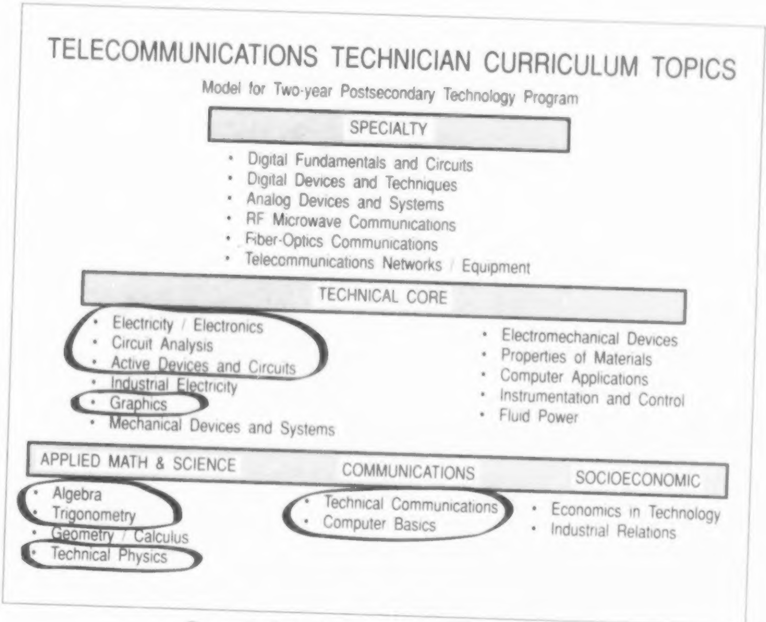
2: Partially proficient: Can do most parts of the task; needs help only on hardest parts. May not meet all entry-level requirements for speed and accuracy. Needs close supervision.

1: Limited: Can do simple parts of task. Needs to be told or shown how to do most of task. Needs extremely close supervision.

0: Cannot perform any part of task at a level sufficient for participation in a work environment.

7. *Identify courses/objectives that can be delivered at the secondary institution(s).* When the TPAD curriculum structure has been designed, the Curriculum Development Committee should ask its high-school representatives, "Which portion of the program would you like to teach? The college will teach the remainder." Giving the high schools this choice reinforces their full standing as equal partners in the consortium.

Usually, when this approach is followed, the high school selects portions of the math, science, communications, and computer courses and the basic courses in the technology. As an example, figure 7 shows a typical high-school selection of courses (circled) from a TPAD telecommunications program. The math, science, and communications courses make up the applied-academics curriculum. The technical courses selected are usually the ones for which high schools can provide adequate faculty and labs, but this is not necessarily the case. In some instances, the high-school students are transported to the college for courses where more optimum faculty and/or labs are available. In other cases, a community college has taught a postsecondary course using a well-equipped lab at an area vocational school or skills center.



TELECOMMUNICATIONS TECHNICIAN CURRICULUM TOPICS

Model for Two-year Postsecondary Technology Program

SPECIALTY

- Digital Fundamentals and Circuits
- Digital Devices and Techniques
- Analog Devices and Systems
- RF Microwave Communications
- Fiber-Optics Communications
- Telecommunications Networks / Equipment

TECHNICAL CORE

- Electricity / Electronics
- Circuit Analysis
- Active Devices and Circuits
- Industrial Electricity
- Graphics
- Mechanical Devices and Systems
- Electromechanical Devices
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Geometry / Calculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

Figure 7: Selection of High-School Courses for a Telecommunications Technician Curriculum

The following guidelines can help in selecting the high-school role in a TPAD curriculum. The high-school component should:

- strengthen the students' background in applied science, math, and communication—that is, it should develop the academic foundation for advanced-skills training,
- build the specific technology upon the academic foundation, and
- provide sufficient technical skills that students are employable after graduation if they cannot continue as full-time postsecondary students. (However, it is recommended that high-school tech-prep lab courses be taught on the basis of

understanding the systems approach rather than narrow job skills.)

8. *Develop secondary/postsecondary TPAD curriculum and administrative guidelines.* This task is the responsibility of the Implementation Committee and is discussed in detail in chapter 4. Some of the issues that must be resolved here are:

- How will credit be transferred and/or shown on transcripts?
- Will fees be charged for transferring credit to the postsecondary institution?
- Who will draft and approve the tests for measuring performance in the high-school courses?
- Will a co-op or internship be included in the program to provide work-based learning experiences?

9. *Determine each institution's requirements and commitment to accomplish its TPAD component.* At this point a very realistic assessment can be made of what each institution will require to carry through with its commitment. Such requirements include adequate staff and planning time, lab equipment, and endorsement of the plan by faculty and staff. This is also an opportune time to assess the level of commitment and enthusiasm on the part of each member of the consortium. Colleges should be making commitment to offer more in-depth advanced-technology courses; high schools should be committed to applied academics and elimination of the general-education curriculum.

10. *Establish a system to certify competencies or educational accomplishments of students in articulated courses to use when they apply for credit at the next educational level.* This task is another responsibility of the Implementation Committee. A comprehensive records-tracking system such as the computer database described in chapter 8 will be needed. Among the issues that will require resolution are:

- How old can an articulated high school credit be and still be counted for postsecondary credit?
- If a student completes only part of a high-school TPAD curriculum, under what conditions can he or she enter the postsecondary program?

11. *Develop a plan to evaluate the TPAD program on a periodic basis.* So far, no TPAD program has been found to be perfect during

the first year of operation. Continual evaluation and refinement of the program are especially important, therefore, especially during the early years of operation. The Evaluation Committee should be formed and working early in the TPAD planning process, and the evaluation plan should be described in the Administrative Articulation Agreement, which is described in chapter 4. Issues covered in the evaluation plan should include:

- What are the expectations of the TPAD consortium for each institution?
- How will fulfillment of these expectations be measured?
- Is the secondary institution adequately preparing its students to articulate into the postsecondary program?
- Are all institutions using the TPAD curriculum and courses?
- Are students being recruited, retained, articulated and employed?
- What percentage of high-school students enrolled in TPAD can be reasonably expected to eventually continue into and/or complete the associate-degree program?

12. *Develop and execute an Administrative Articulation Agreement*. The Administrative Articulation Agreement, which is developed by the Implementation Committee and the TPAD Coordinator, should, at least,

- provide details of the working articulation procedure,
- establish courses to be articulated,
- spell out articulated course competencies,
- describe required proficiency levels and criteria for measurement,
- establish the evaluation plan and process, and
- specify a renewal date for the agreement (no longer than two years).

The agreement should be signed by all members of the Leadership Committee, including business representatives.

13. *Prepare guidance material to recruit students and outline program details*. Guidance counselors play a major role (positive or negative) in effectively executing a TPAD program because they influence the choices that a student makes on course selection. Information about a guidance counselor's role and attitude in TPAD programs is located in chapter 9, and a description and examples of student/counselor TPAD handbooks appear in chapter 8.

14. *Publicize the TPAD program to students, parents and employers.* This task is the responsibility of the Information/Promotion Committee, which is discussed in detail in chapter 4. Information about and examples of effective marketing for TPAD programs, including the making of recruitment videos, are located in chapter 8.

15. *Develop strategies and incentives to maximize student retention in TPAD program.* Full student benefit from a TPAD program requires a four- to six-year commitment from fifteen- and sixteen-year-olds, a group not known for keeping its long-term commitments. Significant incentives are therefore required to provide adequate "holding power" in this process. Some of the incentives that have been used successfully are:

- scholarships and other forms of financial aid for tech-prep graduates who choose to complete the TPAD program at a technical or community college,
- mentoring programs involving one-on-one relationships with industry role models. (A section on mentoring is provided in chapter 9.),
- conducting one or more tech-prep high-school courses on the college campus to give the student a taste of college life, and
- co-op, internship, or summer work programs for tech-prep students.

16. *Arrange access to the program for postsecondary students who did not participate in the high-school articulation program.* The need for changing the TPAD curriculum to provide advanced skills at the postsecondary level was stressed earlier in this chapter. However, such an upgrade in the curriculum requires that all students entering the postsecondary program have improved skills in math, science, communications, and other areas of technical literacy.

The high-school graduates coming from a coordinated tech-prep program will be prepared for such an advanced postsecondary curriculum. For at least the first five years of a TPAD program, however, many if not most students will enter the postsecondary technical program without the benefit of a high-school tech-prep background. To accommodate these students, the postsecondary institution will have to provide at least one term of a "tech-prep equivalent" curriculum, including the applied academics discussed in chapter 3. A diagram showing this process graphically is provided in figure 8. Such a program, being conducted by the Texas State Technical Institute in Waco, Texas, is described in chapter 7.

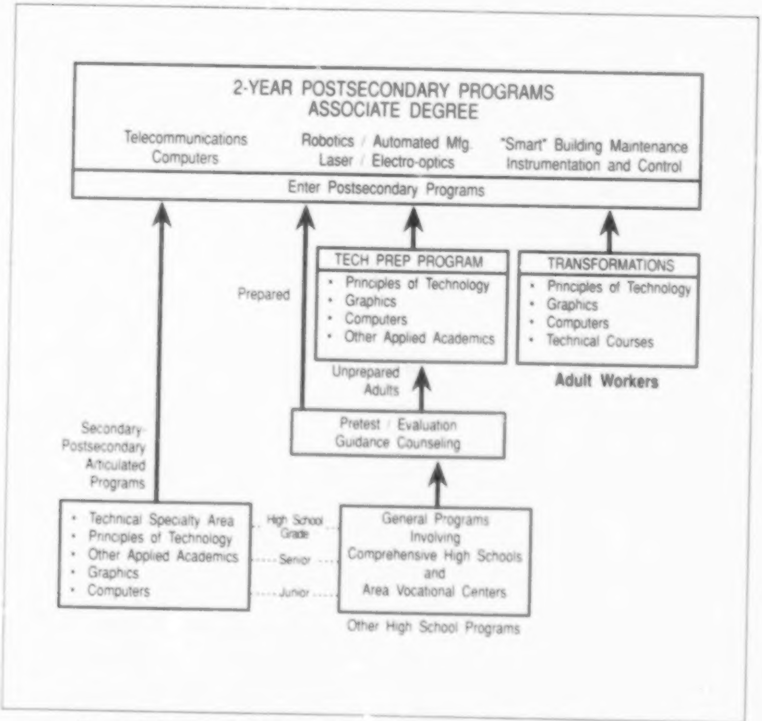


Figure 8: How Will Students Enter Advanced-Technology Programs?

Suggestions for Success in Developing TPAD Consortia

Clearly, the book on articulated Tech Prep/Associate Degree programs is still being written. The experience of existing programs, however, points to certain ingredients for success.

The first and most important ingredient is *commitment* on the part of all entities and institutions involved. In particular, the CEOs of all institutions must make a commitment to do whatever is necessary to make the TPAD program become a reality.

A second vital ingredient is written *agreements*. Writing down policies and procedures helps solidify plans and give a solid base for evaluation. The necessary agreements include both an Executive

Articulation Agreement and an Administrative Articulation Agreement. Both should contain provisions for later revision. They are explained in more detail in chapter 4.

Yet another critical ingredient in success is the early and continuous *involvement* of the faculty, administrators, and counselors from all participating educational institutions. Theirs will be the responsibility of making TPAD a reality. Without their support, the program cannot hope to succeed.

It is always important to keep a steady eye on the fundamental principles behind the TPAD idea:

- advanced skills preparation,
- competency-based curricula,
- curriculum built on a foundation of applied academics, and
- coordination between secondary and postsecondary programs to eliminate delays, duplication, and lost credit.

Finally, the most important ingredient to keep in mind is to clearly identify the *benefits* of a TPAD arrangement to all interested parties. After all, everyone wants to win. And, when properly implemented, Tech Prep/Associate Degree is truly a win-win situation!

3

A SOLID FOUNDATION

The Role of Applied Academics

Leno Pedrotti &
Darrell Parks

"Today, the advent of rapidly changing technologies, both at home and abroad, clearly signals the need for an educational system that combines the best in vocational and academic learning—that is, teaching academic foundation courses in a vocational setting. Such a strategy is generally referred to as applied academics."

3

The crisis in American education is pervasive, extending from kindergarten through high school and beyond. The breadth and depth of this crisis, which involves content, structure, and delivery, have become a national concern. In international competition, the test scores of our best students end up as average. The performance of our average students places us near the bottom. As a result, the problem with American education is addressed daily by specially appointed blue-ribbon committees, by experts on national television, by the President, governors and politicians, by thoughtful editorials in newspapers and journals, and by individuals who are charged directly with the responsibility for educating the youth in our nation's classrooms.

The sounding of the alarm may well have begun with the definitive analysis, *A Nation at Risk*.[1] It was followed in turn by a steady stream of probing, provocative treatises, each designed to raise the country's sensitivity to the problem of a faltering educational system (see list in Appendix D). National leaders at the top levels have been grappling with the problem, sending forth somber pronouncements.

Secretary of Labor Elizabeth Dole, in her 1989 State of the Work Force address, made these observations:

> It was once said that "a school is a building that has four walls and tomorrow inside." And indeed, throughout America's history, the key that has unlocked tomorrow's door of opportunity has been found in our schoolhouses.

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[1] David P. Gardner et al., *A Nation at Risk: The Imperative for Educational Reform*, report of the National Commission on Excellence in Education (Washington, D.C.: Government Printing Office, 1983).

> Today, however, many of our young people are discovering that the locks have changed . . . that the key they received in our schools doesn't fit . . . that they simply don't have the education and skills needed to survive in today's work force.[2]

The Council on Research and Technology (CORETECH) added these depressing statistics in a 1989 publication:

> U.S. 9th graders' science achievement scores rank 15th in a field of 16 nations. Due to this poor mathematics and science preparation, approximately 80 percent of this nation's students are already lost to the future science and engineering labor pool by the time they reach the 10th grade.[3]

In 1990, the National Association of State Directors of Vocational Technical Education Consortium (NASDVTEC) issued a critically important position paper that began with the following telling words:

> Rapid technological change in a highly competitive world economy demands a skilled work force that possesses the basic academic skills necessary for lifelong learning. Academic and vocational-technical education cannot remain exclusive entities competing for limited resources amid finite school boundaries. Rather, all students must be afforded the opportunity to graduate from high school with marketable occupational skills as well as those needed for postsecondary education. An integrated partnership supporting students' varied learning styles is the most effective means of achieving the academic and vocational-technical competence needed in a global economy.[4]

Wherever the message originates, it speaks of an educational system in need of repair. But repair is indeed on its way. Even though it seems to take a while for our resolve to catch up with our know-how, there is no question that America is rising to the challenge.

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[2] "State of the Work Force Address" (Speech delivered to State Teachers and Principals of the Year, Washington, D.C., 26 October 1989).

[3] Council on Research and Technology. *Priorities for a Doubled NSF Budget: The CORETECH Industry-Academic Perspective* (Washington, D.C., 1989).

[4] "Vocational Technical Education: Developing Academic Skills" (Position paper of the National Association of State Directors of Vocational Technical Education Consortium, summer 1990), 1.

In 1958, Russia stunned America with SPUTNIK and its technological advances in space. Ten years later, it was American astronauts, not Russian, who first saw the dark side of the moon and later set foot on the lunar surface. When it comes to the critical area of education, the United States can surely do it again.

APPLIED ACADEMICS: AN EDUCATIONAL STRATEGY FOR THE FUTURE

A large part of the repair needed in our nation's educational system must center around the current state of affairs in our high schools. Few would argue with the claim that the goals of high school education are to:

- develop responsible citizenship,
- prepare students for continued learning, and
- prepare students for employment.

But a dispassionate look at public secondary education today—the main focus of this chapter—reveals that both academic and vocational courses as traditionally taught are missing the mark of preparing tomorrow's technicians for tomorrow's world. Something more is needed. And an important part of that something more may be the inclusion of applied academics in secondary-school and TPAD curricula.

Vocational and Academic Education in the Recent Past

In the middle decades of the twentieth century (1940-1960), preparing high-school students for employment was the central concern of vocational education. It was the vocational educational system that extended the fruits of education to a majority of students who were more likely headed for work after high school than for college. The emphasis of vocational education was placed on acquiring occupational skills to master jobs in the workplace. Understandably, vocational courses placed little emphasis on learning the disciplines of science, mathematics, and English, except as such disciplines were related to specific occupational pursuits.

The reasons for this are quite clear. Vocationally intended students generally shied away from the theoretically based, abstract academic courses developed primarily for the baccalaureate-bound students. Instead, they sought out courses that focused on real devices and their operation in the workplace. Science and mathematics were introduced as related subject matter in vocational courses and taught more or less on an as-needed basis. Communications and people skills were rarely taught.

Consequently, it might be correct to describe vocational education in the mid-twentieth century as education with a predominant focus on learning *how* (hand skills). Learning *why* (head skills)—except when taught as related subject matter—was left largely to the domains of the so-called academic disciplines, and not emphasized in vocational learning.

Preparation for continued learning—generally understood to be the movement from high school into the four-year college system—remained the central concern of academic/general education. Students pursuing academic courses were taught mathematics, science, and English with little attention given to the applications of these abstract concepts to real devices in the workplace. In a sense, then, this type of education might be described as mostly head skills, with very little attention given to the important associated hand skills.

The Merger of Head and Hand

Today, the advent of rapidly changing technologies, both at home and abroad, clearly signals the need for an educational system that combines the best in vocational and academic learning—that is, teaching academic foundation courses in a vocational setting. Such a strategy is generally referred to as applied academics.

But there is a difference. The academic foundation courses referred to here are not the largely abstract, theoretical courses generally made available to the four-year college-bound population. Rather, they are full-fledged academic courses taught in such a way as to engage the "concrete" learner who is more likely to be in a vocational or technical program. These courses target the average student in the middle quartiles of the average high-school population, those most likely to enter technical careers. It seems imperative that we develop programs for these students that not only teach valuable hand skills, but also help them master the associated practical, relevant head skills.

The NASDVTEC position paper cited earlier lends support to this notion:

> It is critical for students to gain instruction and practice in using abstract concepts to efficiently manage practical situations. . . . fragmentation of learning can be combated by a deliberate effort to integrate all learning experiences.

> Applied learning of basic academic skills is the key to such integration.[5]

The need for an educational strategy that provides the nation's future technicians with the right mix of hand-skills and head-skills courses is clear.

It is no longer acceptable for secondary schools to turn out students who are heading for employment brimming with specific job skills but lacking associated academic foundations. Future changes in technology will almost certainly leave them behind.

It is equally unacceptable to educate these students with abstract academic understanding and very few job proficiencies. The electronics technician, for example, who enters the work force with an ability to write and understand complex mathematical equations but with little facility to use an oscilloscope effectively will surely be of questionable value to the industry.

Again, Secretary of Labor Dole captured the essence of the problem in her State of the Work Force address:

> The assembly line jobs that once required only hand-eye coordination are headed the way of the dinosaurs. The same jobs now require the ability to read complex manuals, analyze data, organize information, and make judgments.
>
> For example, in 1965, a car mechanic needed to understand 5,000 pages of service manuals to fix any automobile on the road. Today, with the advent of high-tech electronics, that same mechanic must be able to decipher 465,000 pages of technical text—the equivalent of 250 big-city phone books.

The goals, then, of public education at the secondary level—to develop responsible citizenship, to prepare for continued learning, and to prepare for employment—remain sound. To achieve them for the middle 50 percent of our high-school students in the closing years of the twentieth century, we need only draw from the combined strengths of vocational and academic education, integrating the two, and preparing instructional materials and teaching strategies. In this way, through courses we refer to as "applied academics," high-school education can prepare students effectively for continued learning and employment.

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5. "Vocational Technical Education," 4.

Understanding Applied Academics

Applied academics can be defined as the presentation of subject matter in a way that integrates a particular academic discipline (such as mathematics, science, or English) with personal work-force applications (hands-on laboratories dealing with practical equipment and devices).

In applied academics, a careful balance of "head skill" and "hand skill" learning is developed. The mathematics and science principles that are taught, for example, are related to and explained in terms of the operation of real devices and applications in the everyday work world.

A simple illustration may make this definition more meaningful. Consider the operation of mechanical brakes in an automobile. In the past, an automotive shop course might have focused on training a student to lift a car properly and safely; remove the wheel; replace, repair and adjust the brake mechanism; reassemble the wheel; and test the operation of the brake. These are important hand skills. Ordinarily, not much attention would be given to the physics involved in the operation of an automobile braking system—the head skills.

As it turns out, the operation of mechanical brakes involves a considerable amount of relevant physics—principles such as fluid pressure, mechanical forces, friction, and thermal energy. These topics are often taught as abstractions in standard high-school physics courses. But the thrust in an applied academics course such as Principles of Technology (applied physics) would be to combine the two, as follows:

- Fluid pressure would be related to the system of brake pedal, master cylinder, brake-fluid lines and wheel cylinder, showing how fluid pressure transmits forces from the brake pedal to the brake pad.
- Mechanical forces would be explained as the forces that press the brake pad against the wheel drum in proportional response to the force of the driver's foot on the brake pedal.
- Friction would be put in context as the force that arises when the rough brake pad lining presses against the surface of the wheel drum, with relative motion between the two surfaces.
- Thermal energy would be treated as the heat energy created when two surfaces move against each other at high speeds—and in relation to the need to remove excess heat energy from the surfaces in contact.

A student would leave such an applied-physics course armed with an understanding of relevant physics concepts as they apply to mechanical brakes. Later, in an automotive class, when the focus shifts to adjusting and repairing brakes, this student would have a far greater understanding of the operation of a mechanical brake than a student who had never been exposed to this applied-academics course.

Additionally, the student completing a course such as Principles of Technology will have learned some fundamental physics principles—as related to an automotive braking system—that will remain constant and be transferable to other devices that use fluid pressure, mechanical forces, friction, and thermal energy. Thus, as that student is exposed to new technologies or new applications of an existing technology where such physics concepts are at work, understanding will be greatly enhanced and the application of knowledge and skills will be transferable.

THE DEVELOPMENT OF APPLIED-ACADEMICS LEARNING MATERIALS

In September 1990, Congress passed Public Law 101-392, The Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990. This act refers directly to tech-prep education and applied academics. In Section 343.(3), the law states:

> The term "tech-prep education program" means a combined secondary and postsecondary program which . . . (A) leads to an associate degree or two-year certificate: (B) provides technical preparation in at least one field of engineering technology, applied science, mechanical, industrial or practical art or trade, or agriculture, health or business: (C) *builds student competence in mathematics, science, and communications (including through applied academics) through a sequential course of study:* and (D) leads to placement in employment.[6]

However, the development of applied-academics programs for secondary schools predates this legislation by several years. And although programs of applied academics had been in the conceptual stages for some time, it was the secondary vocational education community that assumed a major leadership role in transforming the concept into reality.

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[6] Congressional Record, 101st Congress, 1st Session, H.R. 22, 3 January 1989, emphasis added.

Early in 1984, a group of state and Canadian provincial leaders in vocational education convened in Indianapolis, Indiana, with representatives from the Agency for Instructional Television and the Center for Occupational Research and Development to address the development and field testing of Principles of Technology, a two-year applied-physics curriculum for secondary vocational education students. Twenty-nine states and two Canadian provinces agreed to invest $2.2 million to support this undertaking.

Based upon positive outcomes gained from the Principles of Technology experience, cooperative developmental efforts among states were continued in other applied-academics disciplines—including Applied Mathematics, Applied Communication, and Applied Biology/Chemistry. To date, a network or consortium of cooperating states has invested over $9 million, primarily from the Perkins Act program improvement funds, to support the development of applied academics in secondary vocational education throughout the nation. Moreover, many additional millions of dollars have been committed by the consortium of cooperating states in the ongoing process of program infusion and implementation of the applied academics materials in their schools.

The vocational-education community worked alongside the academic community—with representatives from business and industry—to develop the right kind of applied-academics courses for vocational students. They took great care to ensure that these courses would not turn out to be just another set of offerings filled with abstract formulas and concepts and largely unrelated to the realities of the work force. At the same time, they made sure that the new applied-academics courses contained sufficient academic rigor and did not represent watered-down substitutes for traditional academic courses.

Each of the courses under development was made to adhere to the following guidelines:

- The course must make sense to the nonbaccalaureate-bound students.
- The course material must be practical and relevant, related wherever possible to the real world of work.
- The delivery of the overall course material must emphasize and include hands-on learning experiences in laboratory environments.
- The course material presented must retain the integrity of the academic discipline.

By early 1990, the first three of the applied-academics courses—Principles of Technology (applied physics), Applied Mathematics, and Applied Communication—were being taught in high schools across this nation. They met with considerable success and were accepted by increasing numbers of students and teachers. The fourth course—Applied Biology/Chemistry, introduced in schools in September 1990—took its place beside the others in the decade of the 1990s.

States in increasing numbers are making applied academics a formal requirement in the education of high-school vocational completers. For example, a 1990 publication by the Ohio Department of Education entitled *Ohio's Future at Work*—representing an action plan for accelerating the modernization of vocational education in Ohio—places clear emphasis on the role of applied academics in the high-school curriculum. The following statements are taken from that document:

- Vocational program completers will have comprehensive educational experiences that include occupational, academic, and employability competencies.
- To achieve this goal, the following objectives must be met: Applied academics (science, mathematics and English/language arts) and technology will be implemented in all secondary occupational programs and will be recommended for full-time adult job specific programs. Start 7/1/90; 75% implementation 6/30/94.[7]

Four Applied-Academics Courses—An Overview of the Possibilities

A brief description of the four applied-academics courses developed with the financial support of the State Directors of Vocational Education follows. Those working to build a new TPAD program may want to include these in their curriculum, or they may choose to incorporate similar applied-academics elements in existing curricula. More specific information about each course can be found in appendix B.

1. *Principles of Technology:* The first of the applied-academics courses—introduced in the fall of 1986—is now being used by over

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[7] *Ohio's Future at Work: Action Plan for Accelerating the Modernization of Vocational Education in Ohio* (Columbus, OH: Ohio Department of Education, 1990), 10.

thirty-five thousand students in forty-eight states and two Canadian provinces. The two-year course can be described briefly as follows. It is:

- an applied-science (physics) course for secondary-school vocational education students—and others;
- an integrated set of instructional materials that combines video instruction, work from printed materials, and laboratory experience;
- based on the application of physics principles in mechanical, fluid, electrical and thermal energy systems—and emphasizes the analogies between these systems;
- heavily laboratory oriented, with half of the course concentrating on realistic problem-solving mathematics laboratories and hands-on hardware laboratories.

Principles of Technology describes the fourteen technical principles listed in figure 1. It does so in practical language and relates the principles to specific problems. Throughout the fourteen units—seven for each year—emphasis is placed on how the principles unify an understanding of the mechanical, fluid, electrical and thermal systems found in modern technical equipment. Learning about principles and systems together ensures future career flexibility as machines and technology change and advance.

For students who seek further education after high school, Principles of Technology provides an important academic foundation. For students who seek immediate employment after high school, it provides a base for understanding the job better and for changing with the job as technology changes. And for students who later decide to attend a four-year baccalaureate program, this course will not be wasted. Many colleges and universities across the nation now accept Principles of Technology as a high-school laboratory-science course.

First Year	**Second Year**
Force	Momentum
Work	Waves
Rate	Energy Convertors
Resistance	Transducers
Energy	Radiation
Power	Optical Systems
Force Transformers	Time Constants

Figure 1: Principles of Technology Units

2. *Applied Mathematics.* First introduced in the fall of 1988 and now in use by thirty thousand students in forty-four states, Applied Mathematics is:

- an integrated set of instructional materials that provides video instruction, work from printed materials, hands-on laboratory experience that involves extensive measurement, and practical problem-solving activities in agriculture/agribusiness, health occupations, home economics, business and marketing, and industrial technology;
- based on an integrated presentation of topics in arithmetic, algebra, geometry, trigonometry, probability, estimation, problem solving, and statistical process control; and
- oriented toward application and practice of mathematical concepts and skills, and practical, world-of-work problems.

The thirty-six modules in Applied Mathematics are designed to be used in two one-year courses for academic credit toward high-school graduation (see figure 2). Alternatively, separate modules can be selected as needed and infused into existing vocational courses of study. Though the units include the mathematics principles and concepts found in the traditional areas of arithmetic, geometry, algebra, simple trigonometry, and statistics, emphasis is squarely placed on the ability to understand and apply mathematics to the solution of real-world problems.

Applied Mathematics is especially helpful for students who are not necessarily baccalaureate-bound and who may feel a certain anxiety about mathematics. It has been prepared for learners who have an eighth-grade prealgebra mathematics competency level and is written at the sixth- or seventh-grade reading level. Consequently, it may be used effectively—even if at a slower pace—with traditionally underserved students.

The innovative component in the Applied Mathematics student materials is the use of hands-on activity laboratories. Three activities are designed for each of the thirty-six modules. These activities are performed in the classroom, in the hallways, in the gymnasium, or on the school grounds and involve students in measurement and use of measuring tools. These activities encourage students to take a participatory role in gathering and analyzing data, thereby helping them see the usefulness and applicability of mathematics.

Applied Mathematics I

A. Getting to Know Your Calculator
B. Naming Numbers in Different Ways
C. Finding Answers with Your Calculator
1. Learning Problem-solving Techniques
2. Estimating Answers
3. Measuring in English and Metric Units
4. Using Graphs, Charts, and Tables
5. Dealing with Data
6. Working with Lines and Angles
7. Working with Shapes in Two Dimensions
8. Working with Shapes in Three Dimensions
9. Using Ratios and Proportions
10. Working with Scale Drawings
11. Using Signed Numbers and Vectors
12. Using Scientific Notation
13. Precision, Accuracy, and Tolerance
14. Solving Problems with Powers and Roots
15. Using Formulas to Solve Problems

Applied Mathematics II

16. Solving Problems That Involve Linear Equations
17. Graphing Data
18. Solving Problems That Involve Nonlinear Equations
19. Working with Statistics
20. Working with Probabilities
21. Using Right-triangle Relationships
22. Using Trigonometric Functions
23. Factoring
24. Patterns and Functions
25. Quadratics
26. Systems of Equations
27. Inequalities
28. Geometry in the Workplace 1
29. Geometry in the Workplace 2
30. Solving Problems with Computer Spreadsheets
31. Solving Problems with Computer Graphics
32. Quality Assurance and Process Control 1
33. Quality Assurance and Process Control 2

Figure 2: Learning Modules for Applied Mathematics

The Applied Mathematics materials fully reflect the standards set up by the National Council of Teachers of Mathematics.[8] Their consensus, based on input from many math educators, is that successful completion of two years of Applied Mathematics will fulfill requirements for Algebra I and at least a half-year of informal geometry. In addition, it is their opinion that a student who successfully completes Applied Mathematics I and II can enroll in Algebra II and/or formal geometry if that be desirable. In a sense then, a student who commits to Applied Mathematics I and II in the ninth and tenth grades can still move into the baccalaureate-bound mathematics sequence in the eleventh and twelfth grades.

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[8] National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards for School Mathematics* (Reston, VA: National Council of Teachers of Mathematics, 1989).

3. *Applied Communication.* Introduced in the fall of 1988 and widely used in forty-six states, this one-year course is a resource for students that:

- teaches communication, language-arts, and English skills as they apply in the workplace,
- sharpens reading, writing, listening, speaking, problem-solving, visual, and nonverbal skills,
- strengthens the academic foundations of the curriculum, and
- features applications for agriculture, business and marketing, health occupations, home economics, technology, trade and industry.

Applied Communication is a comprehensive set of video-based learning materials designed to help students develop and refine job-related communication skills. The learning materials are divided into fifteen instructional modules (see figure 3) and include a total of one hundred fifty lessons.

Communicating in the Workplace
Gathering and Using Information in the Workplace
Using Problem-Solving Strategies
Starting a New Job
Communicating with Co-Workers
Participating in Groups
Following and Giving Directions
Communicating with Supervisors
Presenting Your Point of View
Communicating with Clients and Customers
Making and Responding to Requests
Communicating to Solve Interpersonal Conflicts
Evaluating Performance
Upgrading, Retraining, and Changing Jobs
Improving the Quality of Communications

Figure 3: Learning Modules for Applied Communication

The fifteen modules with accompanying video can be used singly, in any order, to enhance existing communication, language arts, English, or vocational-technical courses. Or, they can be used together as the basis for a one-year course. The learner materials are designed for use with individuals who have at least an eighth-grade reading ability.

4. *Applied Biology/Chemistry.* The last of the applied-academics courses intended for students at the high-school level—Applied Biology/Chemistry—is still under development. Pilot testing of the first-year materials began in fall of 1990, with full availability of the two-year course set for the decade of the 1990s. Applied

Biology/Chemistry follows the same pedagogical model as Principles of Technology and Applied Mathematics. In brief, this course:

- consists of twelve units that present the scientific fundamentals of biology and chemistry and provide a foundation for careers in technology, health, agriculture/agribusiness, or home economics,
- integrates biology and chemistry as a unified domain for the purposes of teaching,
- employs student activities that relate to work and other life experiences,
- can be used alone as a science or technology course or infused into existing courses, and
- provides materials that are suitable for high-school students or for adults in retraining programs.

Applied Biology/Chemistry involves an instructional system of twelve units (see figure 4) with a vocational emphasis that treats biology and chemistry as a unified science. The units, each designed for fifteen to thirty hours of student activity, may be infused into existing curricula or taught together as a one- or two-year stand-alone course. As in the other applied-academics courses, the instructional units include video, a student text with laboratory activities, a teacher's guide, and a resource guidebook.

The course materials have adopted an instructional strategy recommended by the National-Science-Foundation-funded study, Project Synthesis, which emphasizes the importance of teaching science in the context of major life issues.[9]

Addressing occupational, personal, and societal issues, Applied Biology/Chemistry has followed an approach that is consistent with the National Science Teachers Association's Criteria for Excellence.[10] Further, the Applied Biology/Chemistry curriculum is consistent with the recommendations relative to both content and effective learning and teaching as expressed in *Project 2061: Science for All Americans.*[11]

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9. N. C. Harms and R. E. Yager, eds., *What Research Says to the Science Teacher*, vol. 3 (Washington, D.C.: National Science Teachers Association, 1987).

10. National Science Teachers Association, *Criteria for Excellence* (Washington, D.C.: National Science Teachers Association, 1987).

11. American Association for Advancement of Science, *Science for All Americans: A Project 2061 Report on Literacy Goals in Science, Mathematics and Technology* (Washington, D.C.: American Association for the Advancement of Science, 1989).

Natural Resources
Water
Air and Other Gases
Plant Growth and Reproduction
Continuity of Life
Nutrition
Disease and Wellness
Life Processes
Synthetic Materials
Waste and Waste Management
Microorganisms
Community of Life

Figure 4: Learning Modules for Applied Biology/Chemistry

INTEGRATING APPLIED ACADEMICS INTO A TPAD PROGRAM

In a TPAD program, as described in chapter 2, the overall intent is to couple learning in high school with follow-on learning in a postsecondary institution (community college or technical institute) in accordance with a carefully prepared, coordinated curriculum. To make this an efficient, articulated 2+2 or 4+2 program, the choice and sequence of courses in the four-year high school become critical.

Applied academics can be used effectively at any point in the foundational core of a TPAD program. Experience has shown, however, that students receive maximum benefit when *all four years* of high school become available for selection and positioning of applied-academics courses. In other words, while 2+2 TPAD programs are certainly workable and beneficial, 4+2 programs offer more options and flexibility. For this reason, the examples that follow describe 4+2 TPAD curricula.

Offering Applied Academics in High School

Figure 5 shows a partial distribution of courses or course sequences generally required for high-school graduation and suggests a possible sequence of applied-academics courses.

Several observations relative to this suggested course of study are in order.

First, in the mathematics sequence, Applied Mathematics I and II are to be taken in the ninth and tenth grades, respectively. Inclusion of Applied Mathematics in the first two years of high school provides the vocationally intended students with a sound, functional foundation in mathematics.

This foundation serves students in the vocational courses that follow and provides them with a solid base upon which to build further learning in mathematics. At the same time, taking Applied

Mathematics in the first two years of high school keeps their options for further mathematics open. Those who change career plans and decide to pursue a four-year college degree can then enter the traditional, baccalaureate-bound mathematics sequence, taking Algebra II in the junior year and a high-level geometry or precalculus course in the senior year. Selection and satisfactory completion of these follow-on courses enables students to meet most college-entrance requirements in mathematics.

	9th Grade	10th Grade	11th Grade	12th Grade
MATH	Applied Math I	Applied Math II	Algebra II	Formal Geometry
SCIENCE	Applied Biology/ Chemistry	Principles of Technology I	Principles of Technology II (Optional)	
ENGLISH	English I, II, and III and Applied Communication			
SOCIAL STUDIES	Geography, History, and Government			
OTHER			Vocational Education Concentration	Vocational Education Concentration

Figure 5: Applied Academics in a Four-Year High-School Program

In the science sequence, Applied Biology/Chemistry is listed for the ninth grade, with Principles of Technology I following in the tenth grade and—if time permits—Principles of Technology II or another science course in the eleventh or twelfth grade. Another observation here is in order. Students who take Applied Mathematics in the ninth grade are likely to complete Principles of Technology in the tenth or eleventh grade with a higher degree of success. Again, an increasing number of four-year colleges and universities now accept Principles of Technology as an entrance requirement for laboratory science. This benefits those students who take Principles of Technology in high school and subsequently decide to enter a four-year college program.

The sequence of four English courses generally required in our high schools has been modified to make room for one year of Applied

Communication. Different states are trying Applied Communication at different grade levels, and some are infusing Applied Communication modules into English courses during all four high-school years. Its specific position in the curriculum has been left up to administration and teachers in the local school districts.

The "Other" category has purposefully been left open. Different schools and different states have differing sets of requirements that generally will be met here. However, it is vital to include concentration in a vocational cluster area in the junior and senior years. The specific area of concentration—whether transportation, health occupations, electronics, manufacturing, human services, construction techniques, or another field—is less important than the practice and learning of valuable hand skills that occur in vocational courses. To provide students with applied-academics courses and deprive them of associated hand-skill training in vocational areas would be to do them an injustice. Fortunately, in most 2+2 or 4+2 programs, concentration in a vocational area in the high school is a built-in part of the curriculum.

Building a 4+2 Program on an Applied-Academics Foundation

Once agreement has been reached on how to include applied-academics courses into the four-year high-school curriculum, then it is time to examine the overall picture of an articulated TPAD program. There is certainly more than one way to go, as evidenced by the successful TPAD programs already in existence. What follows does not pretend to be *the* model—or even one of the best models. It is simply a suggestion based on a well-tested field—the field of electronics. It is purposely a "best case" scenario—an ideal program. Including every aspect of such a program may not be possible in a real school situation. But the ideal model does represent something to aim for.

Figure 6 lays out the detailed course selection for a 4+2 tech-prep program in electronics—with concentrations in the digital/computer area. In addition to showing the division of courses between the high-school and postsecondary components, this chart also lists the overall sequence of courses—secondary and postsecondary—in the generally well-understood categories (math, English, science, social studies . . . technical specialty). The specific titles for the electronics courses that form the core of a digital/computer program are not important in themselves. They are included primarily to indicate general content.

A detailed examination of figure 6 reveals that the applied academics courses suggested for secondary school retain their

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication				Technical Communications			
SCIENCE	Applied Biology/Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective				Economics in Technology
OTHER	Technology Education	Elective						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Computer Lang. & Programming	Linear ICs & Analog Circuits	Computer Applications	Digital Devices & Techniques
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Analog Devices & Systems	Digital Fund. & Circuits	Microprocessors	Digital Computer/ Interfacing

Figure 6: A 4+2 Tech-Prep Model for Electronics/Digital Computer Major

respective positions in the proposed 4+2 TPAD program. The math sequence is extended at the postsecondary level to include trigonometry and calculus—or statistics, and the sequence of high-school English courses is followed by a course in technical communication at the postsecondary level.

The science sequence is extended at the postsecondary level to include a course entitled Physics for Technicians. This is a specially prepared, one-year physics course that builds on the Principles of Technology courses completed at the high-school level.

The technical core and technical specialty categories at the high-school level include the vocational concentration addressed earlier. Here six courses are included: Technical Graphics, Electronic Fabrication and Testing, DC/AC Circuits, Circuit Analysis, Active Devices I and Digital Devices. In this collection of courses, valuable hands-on concentration with electronic equipment is achieved. In addition, these courses make practical application of math and science principles introduced in Applied Mathematics and Principles of Technology.

This basic sequence of technical core/technical specialty courses begun in high school is extended into the four semesters at the postsecondary level. In all, there are fourteen courses, including one elective. In the technical core area, five courses are indicated. These are courses generally outside the specialty area; their purpose is to provide the technician with important breadth. In the technical specialty area (in this case, digital/computer electronics), eight courses are identified. These courses provide the needed depth in the specialty area. They constitute the courses needed to establish the graduate of this program as a credible and well-trained technician in the field of digital/computer electronics.

In the "Other" category, several courses have been identified to round out the overall preparation of the digital/computer electronics technician. Some are required for the high-school diploma, others are desirable for a well-educated technician.

Admittedly, the "ideal" 4+2 TPAD program depicted in figure 6 is in a highly technical area. The overall plan, however, works equally well for other types of programs such as cosmetology, health careers, and fashion merchandising. Some of these are listed in appendix B, along with the names and phone numbers of people and programs who have tackled the challenge of creating 2+2 or 4+2 tech prep for these specialties.

WHO BENEFITS FROM APPLIED ACADEMICS?

Everyone benefits when the applied-academics courses outlined in this chapter—or reasonably equivalent courses—are included in a secondary-school program and used as a basis for a TPAD curriculum.

For students, applied-academics courses:

- build a solid base of math, science, and communications principles;
- build a foundation for postsecondary technical education programs;
- provide a broad knowledge base that ensures flexibility in a changing work force; and
- make math, science, and communications courses more accessible and less threatening to a large majority of learners.

For teachers, applied-academics courses can:

- bridge the gap between the vocational and academic sides of the "house;"
- relate the academic principles to the practical world of business and industry; and
- make teaching math, science, and communication a more successful experience.

In addition, employers benefit because the courses:

- raise the level of mathematic, science, and communication skills for entering workers;
- provide a work force that can be trained and retrained effectively as the need arises; and
- move industry into a closer partnership with education.

Figure 7, which shows the paths that lead from a high-school education to the world of work, graphically illustrates the pivotal foundational role applied academics can play. When integrated with concentration in a technical specialty area, applied-academics courses form a solid yet flexible foundation. This foundation enables students to move directly from high school into the world of work—if that is their desire—better prepared to meet current job requirements and future changes, or the foundation prepares them to proceed immediately to an articulated 4+2 TPAD program for further education. Either way, applied academics at the secondary level is a win-win experience.

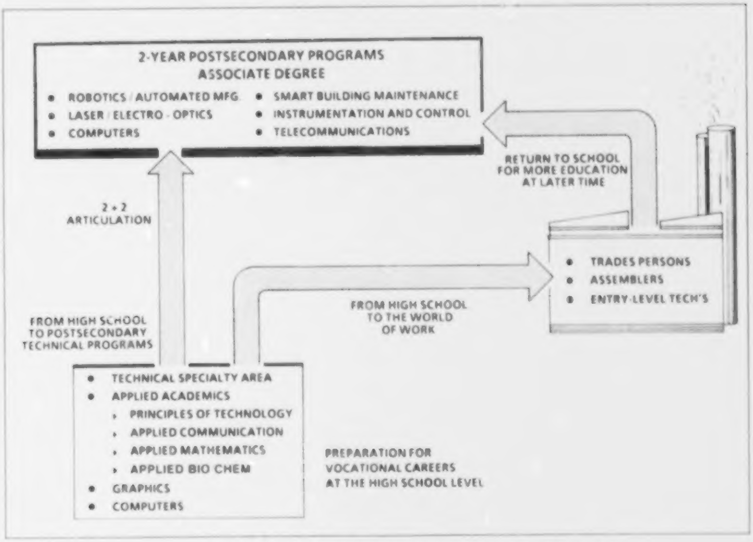

2-YEAR POSTSECONDARY PROGRAMS
ASSOCIATE DEGREE
ROBOTICS / AUTOMATED MFG.
LASER / ELECTRO - OPTICS
COMPUTERS
SMART BUILDING MAINTENANCE
INSTRUMENTATION AND CONTROL
TELECOMMUNICATIONS
RETURN TO SCHOOL FOR MORE EDUCATION AT LATER TIME
2 + 2 ARTICULATION
TRADES PERSONS
ASSEMBLERS
ENTRY-LEVEL TECH'S
FROM HIGH SCHOOL TO THE WORLD OF WORK
FROM HIGH SCHOOL TO POSTSECONDARY TECHNICAL PROGRAMS
TECHNICAL SPECIALTY AREA
APPLIED ACADEMICS
PRINCIPLES OF TECHNOLOGY
APPLIED COMMUNICATION
APPLIED MATHEMATICS
APPLIED BIO CHEM
GRAPHICS
COMPUTERS
PREPARATION FOR VOCATIONAL CAREERS AT THE HIGH SCHOOL LEVEL

Figure 7: Applied Academics at the Secondary Level
Increases Opportunities for Many

4

IT'S A TEAM EFFORT!

Developing and Implementing A TPAD Program

Maurice Dutton

"A Tech Prep/Associate Degree program requires the support and active input of the entire community: members of business, industry, labor, civic organizations, and government, as well as educational institutions."

4

Teamwork and group problem solving are key elements in the new, high-performance organizations that lead today's global economy. The emergence of employee problem-solving groups such as Quality Circles illustrates the importance and emphasis business and industry are placing on team efforts and group performance. Focused, flexible team efforts consistently exceed those produced by the same number of individuals working alone. These synergistic activities are indeed examples of the whole being greater than the sum of the parts.

BUILDING A TPAD TEAM

Teamwork and group problem solving not only are basic but are critical to the development and implementation of a Tech Prep/Associate Degree program. When building a TPAD team, it is especially important to involve those who will ultimately deliver the program services to the students—the faculty and counselors of both secondary and postsecondary schools. A TPAD program cannot succeed without their solid commitment. However, a TPAD program is not an isolated activity affecting only those involved in educational institutions. It is a comprehensive educational program designed to help students become responsible and productive citizens in an increasingly complex, technologically driven society. As such, it requires the support and active input of the entire community; members of business, industry, labor, civic organizations, and government, as well as educational institutions. This support and input must be organized and coordinated through functional, focused teams with representatives from every facet of the community.

Managing Change

Earlier chapters have made it clear that functioning responsibly and productively in today's technologically driven society requires different knowledge and skills—and different educational programs—than living in the nineteenth- and twentieth-century industrial society. We are in a time when major changes are occurring in the way we live and work. Major changes must occur in our educational programs and institutions as well.

These required changes involve far more than just modifying curricula. Change must also occur in:

- *expectations*—high levels of performance must be expected from all our students.
- *attitudes*—ideas about the quality and worth of technical education and careers must be reevaluated.
- *teaching styles*—teaching styles and techniques must correspond to the learning styles of all students, not just part of the students.
- *organizational structures*—segmented, bureaucratic, hierarchical organizations are counterproductive to the initiative and flexible team efforts required of front-line workers (and teachers).

A TPAD program can provide the opportunity and the vehicle for bringing about these changes.

Planning and implementing a TPAD program are not simple, short-term procedures. Rather, they are part of a long-term, complex process that, if fully implemented, results in the restructuring of vocational education. The process should also involve the academic faculty and be used as an opportunity to restructure the entire educational program. A few secondary-school districts already are using TPAD as an alternative to general education. These school districts have three basic programs for their students: academic, vocational, and tech prep, with ample provisions for movement between the three (see figure on page *xx* at front of book).

For a new program to become a permanent part of an organization, the changes it brings must become an integral part of the organization's culture. This requires that all segments of the organization:

- become knowledgeable about the basic elements of the change,
- are capable of doing those actions needed, and
- believe that the actions are worthy of doing.

For this to occur, the members of the organization will need to be challenged, motivated, nurtured, involved, and provided with adequate support over an extended period of time.

Major institutional change requires a clear vision of something better—something sufficiently better to capture the imagination and support of those who must expend the effort to make change happen and "suffer through" the transition period. In the case of TPAD, the "something better" can be expressed in terms of the benefits of a comprehensive, well-planned and implemented, TPAD program. The benefits for all parties involved are many. Perhaps the most important, however, is a well-trained work force that is able to earn a good wage, keep the American economy competitive, and keep the American standard of living high.

Even though many individuals and organizations recognize the need for change, most tend to resist it. Change requires new knowledge, new skills, and new relationships. And although change brings the opportunity for new achievement and new rewards, it also brings the threat of loss. It requires giving up the comfort of the familiar and possibly losing the rewards associated with current status and relationships which must be reearned or reestablished.

Those initiating and sustaining efforts toward change must recognize that these fears are both understandable and realistic. This means that they must not only promote the potential rewards of the effort, but also do everything possible to see that the rewards become realities. The good news is that the rewards are real! A TPAD program is capable of delivering benefits that create a win-win situation for all involved.

Meeting the Concerns of All Involved

Who are the members of this team who must understand and embrace this new vision, who will bring about the changes, and who will receive the benefits? They include the board members, administrators, faculty, and counselors of the secondary and postsecondary educational institutions involved; the owners and managers of the local businesses and industries that need trained workers; the students and parents of students who will benefit from the educational programs; and elected officials and other public servants who must deal with the successes and failures of our educational system.

In the process of recruiting and involving these team members, it is important to recognize the particular concerns of each and understand how a TPAD program can respond to these concerns.

School-board members, for example, are concerned about the overall capability of the school system to meet the expressed needs of their community. (They are often told it is not doing so.) They also must deal with the cost of financing the educational system while citizens are resisting new taxes.

School administrators are concerned about the adequacy of the skills and abilities of their students, about the high dropout rates, and about meeting the needs of their "at-risk" students (whose percentage of the student population is increasing).

Both *secondary and postsecondary faculty* are concerned about the high dropout rates and the low achievement levels of many of their students. They also worry about their own ability to respond to and meet the needs of the increasing numbers of at-risk students.

Local employers are concerned about having a labor pool with adequate literacy (reading, writing, computation) and technical skills. They also need employees who can use initiative in problem solving and who are capable of working effectively in teams. Their survival depends upon it.

A large percentage of *students* (the 40-50 percent in general education programs) are unfocused and uncertain as to what they will do or what the future has for them. Since they are unfocused, many are also unmotivated. For them, the future is bleak.

Parents of these students are generally concerned that their children get a "good education" that leads to a "good job." Most of them still want their children to attend college. And few of them are aware that the general-education program does not prepare their children adequately for either.

Public servants—both elected officials and agency staff members—are concerned, much like the school-board members, that the educational system produces employees and citizens who can function effectively and maintain a highly competitive work force.

All of these concerns are based on situations that require positive changes in our perceptions of our educational institutions and their educational programs. A TPAD program can be the opportunity, the vehicle for bringing about the changes that will alleviate many of these concerns.

Maintaining Communication and Involvement

Open communications and active involvement are key concepts to any successful team effort. It takes a lot of time and effort to involve everyone and to keep everyone informed. However, only by maintaining high levels of communication and involvement will you maintain high levels of support and commitment among the people who are vital to TPAD success.

Communication and involvement mean more than keeping people informed through meetings, letters, newsletters, brochures, posters, and news releases. They also mean providing ongoing opportunities for feedback—having a "comment time" in meetings, conducting written surveys, promoting committee work, and keeping an "open door." Communication and involvement also require allowing those affected by policies and programs to have some say in the decision making.

Involvement should be approached from the viewpoint that all persons developing and delivering the TPAD programs and all persons receiving the benefits are partners. The concept of partnership is basic to the whole TPAD team effort. Partners have both rights and responsibilities—the right to share in the benefits of joint effort, and the responsibility to contribute resources and effort to making the program a success. Partners are responsible not only for themselves, but for the success of the entire effort. Partners must look out for the interests of all concerned.

Partnerships thrive on the shared strengths of their members. It is vital, therefore, that partners assist each other. (Stronger partners equal stronger partnerships.) If a partner is weak, attention should be given toward helping that partner become stronger. (Partners don't drown alone; partners swim or sink together.)

Open communication and extensive involvement of all partners should start from the very beginning of the planning process and should be built into every aspect of the development and implementation of the TPAD program.

ADMINISTERING A TPAD PROGRAM

Successful TPAD programs are, by nature, the products of deliberate planning and cooperation. Each member organization takes responsibility not only for its own assigned areas, but also for the overall success of the TPAD program. Commitment from the top administrators in all organizations is essential. In addition, each organization must have one or more persons responsible for operational aspects of their own organizational efforts and for coordination with the other organizations.

Overall administration and coordination of the TPAD team can be conducted through a representative task force or committee. However, the consortia that appear most successful are ones who have enlisted a full-time TPAD coordinator. This coordinator assumes overall administrative responsibility for the development, implementation, and coordination of the TPAD program. The amount of work involved in scheduling meetings, bringing committees together, conducting orientations and training, gathering information, and preparing news releases and other promotional materials, as well as monitoring the implementation of the operational plan and evaluative activities requires more than a part-time effort or periodic committee assignments.

Selecting a TPAD Coordinator

The TPAD coordinator should be selected by and be responsible to the Leadership Committee. He or she should have administrative experience at the secondary and/or postsecondary level, including specific experience in vocational-technical education. The coordinator must also have good administrative skills and be able to coordinate and support all of the committee activities. The coordinator must have a clear vision of the overall TPAD program, an understanding of what needs to be accomplished, and the ability to transmit this vision and understanding to the various committee chairpersons.

The TPAD coordinator should be responsible for coordinating the activities of all of the committees and providing logistical and support services, as needed. In some cases, the coordinator's office may actually produce some of the materials (working with the committees), for example, publishing a newsletter, or overseeing the printing of materials or the production of a video. The coordinator should be an ex officio member of all of the committees and meet with them whenever possible. He or she also should have regularly scheduled meetings with the committee chairpersons. The coordinator may mediate and resolve any disputes that occur between committees and will be responsible for preparing reports on the TPAD program and "driving the schedule."

The TPAD coordinator will also be a liaison with business, industry, and labor, as well as with local civic and governmental organizations. He or she should be active in promoting the TPAD program to the community and seeking community involvement. The coordinator should be a good speaker and be prepared to make frequent presentations on the TPAD program.

The TPAD coordinator should be employed full-time and be allowed a full-time secretary for supporting office functions and the committees. Administrative logistics (office space, equipment, utilities, supplies) will need to be arranged and budgeted. Sometimes the coordinator is an employee of one of the consortium members; in other situations, he or she is jointly employed but provided benefits and support through one of the member institutions.

Planning the TPAD Program

The degree of success in implementing any program rests on the adequacy and thoroughness of the operational plan developed, the adequacy of resources available, and the timeliness and competencies of those implementing the plan. In order to ensure the best plan possible, all partners of the TPAD program effort should be involved.

A team effort in developing and implementing the TPAD program plan will help ensure that:

- community and institutional needs/problems are identified,
- common and generally supported goals and objectives are identified,
- vested interests are identified and compromises, where needed, are worked out in advance,
- detailed operational events and activities (along with related products and/or outcomes) are identified and a reasonable timeline for completion is laid down,
- resources required are identified as well as potential sources/ways of acquiring these resources,
- an evaluation plan is developed to determine the degree to which the operational plan is successfully implemented, changes or modifications are required, and desired outcomes are achieved.

A three to five-year time frame should be projected for planning and fully implementing a comprehensive TPAD program. The first year is devoted to forming the consortium; hiring or appointing a TPAD coordinator; setting up the five committees; carrying out a needs assessment; identifying and securing resources; developing an operational plan; orienting and securing the commitment of the various team members; identifying and modifying or rewriting the TPAD curricula to be implemented the following year; providing inservice training for administrators, faculty, and counselors; preparing and orienting students and parents; implementing general promotional efforts in the community, and conducting evaluative activities.

The second year will be devoted to implementing those TPAD curricula that were prepared during year one; continuing inservice training; continuing promotional programs with students and parents, business and industry and labor, and the general community; and identifying and modifying or rewriting the TPAD curricula to be implemented during year three as needed.

The second cycle will then be repeated until all appropriate curricula have been converted to TPAD and/or the restructuring of the educational programs of the schools is complete. This may involve adding a middle school (junior high) career-exploration component and replacing the general-education program with a tech-prep program.

Identifying and Securing Resources

Additional resources for TPAD—those required beyond the normal budget—are typically needed only for the planning, developing, and implementing stages. These costs relate to such items as hiring and orienting a coordinator; setting up an office; developing and producing promotional materials; developing and/or modifying curriculum materials; collecting and processing evaluative data; developing and conducting training workshops for administrators, faculty, and counselors; and arranging released time for faculty and counselors to attend workshops and/or develop curricula.

Many TPAD programs have been started through special grants utilizing state and federal vocational education monies. Funds also have been provided by local businesses and industries. However, many school districts consider the modification of curricula to meet the current needs of society and their students to be a legitimate part of their regular school-district budget.

PUTTING COMMITTEES TO WORK

The whole process of planning, developing, and implementing a TPAD program is very labor-intensive. The use of committees is a very common and productive way of involving large numbers of people and dividing up the workload It is important that all committees include representation from secondary institutions; two-year postsecondary institutions; business, industry, and organizations; and possibly other local organizations such as the Chamber of Commerce or JTPA.

As explained earlier, the following five committees make up an effective working organization:

- Leadership Committee,
- Implementation Committee,
- Curriculum Development Committee,
- Information/Promotion Committee, and

- Evaluation Committee.

The committees may be given different names, and the tasks within the committees may be grouped differently. The commitee structure described below, however, covers the tasks that need to be accomplished in planning, developing, and implementing a successful TPAD program.

Leadership Committee

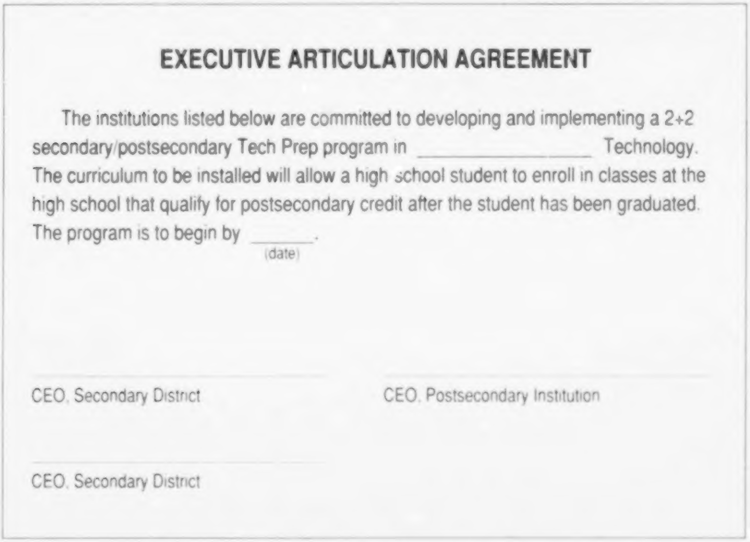
The primary purpose of the Leadership Committee is to commit the institutions in the consortium to a TPAD program and to make that commitment highly visible—both to members of the institutions involved and to the general public. This committee also has overall responsibility for the program and makes final decisions. In addition, it should be "keeper of the vision"—making sure everyone involved has a clear view of what the TPAD program is intended to accomplish.

The Leadership Committee normally consists of the chief executive officers of the educational institutions, businesses, and industries participating in the consortium. It also may involve board members of the participating institutions. This committee can expand its membership by inviting other institutions or organizations to join the consortium.

The members of the Leadership Committee, when they begin to meet, should develop a simple Executive Articulation Agreement that:

- includes a statement that formally begins the developmental process,
- commits the institutions to the TPAD articulation process,
- establishes the target date for having the articulated programs in effect, and
- carries their signatures (see figure 1).

In addition, the Leadership Committee should establish the Implementation Committee and endorse the Administrative Articulation Agreement. (The remaining committees will be appointed by the Implementation Committee.) The Leadership Committee should meet on an "as-needed" basis to monitor the development and implementation of the TPAD program and should review and endorse the Administrative Articulation Agreement once a year.



EXECUTIVE ARTICULATION AGREEMENT

The institutions listed below are committed to developing and implementing a 2+2 secondary/postsecondary Tech Prep program in ________________ Technology. The curriculum to be installed will allow a high school student to enroll in classes at the high school that qualify for postsecondary credit after the student has been graduated. The program is to begin by ______.
(date)

CEO, Secondary District

CEO, Postsecondary Institution

CEO, Secondary District

Figure 1: Sample Executive Articulation Agreement

Implementation Committee

The Implementation Committee is the administrative "workhorse" of all the committees. This group is responsible for making the major decisions that go into the Administrative Articulation Agreement and for establishing the other three committees (Curriculum Development, Information/Promotion, and Evaluation) which report back to it. The Administrative Articulation Agreement and committee appointments are subject to review by the Leadership Committee.

The Implementation Committee should consist of top-level administrators from the educational institutions (vice presidents, deans, assistant superintendents, principals), business, industry, and labor (vice presidents, managers), and governmental agencies (administrators, assistant administrators) belonging to the consortium. Members are appointed by the Leadership Committee, and membership may be expanded as new institutions or organizations join the consortium.

The selection of the Implementation Committee chairperson is critical not only to the success of the committee, but to the entire TPAD program. This person must be a recognized, strong leader in the educational community, preferably of the rank of assistant superintendent, vice president, or dean. He or she needs dynamic personal qualities, as well as good administrative and planning skills. Like the coordinator, this person must have a clear vision of the overall TPAD program, an understanding of what needs to be accomplished, and an ability to transmit these to the committee members. Finally, the chairperson must have high expectations for committee members and the ability to motivate and support them.

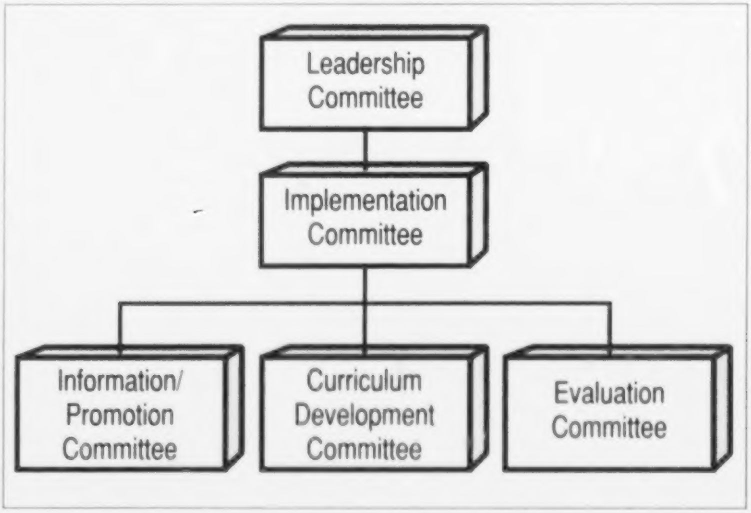

Leadership Committee
Implementation Committee
Information/ Promotion Committee
Curriculum Development Committee
Evaluation Committee

Figure 2: Committee Relationships in a TPAD Consortium

It is important that the Implementation Committee establish the Curriculum Development, Information/Promotion, and Evaluation Committees at the very beginning of the planning process. This includes appointing the members, assigning the chairpersons, outlining the goals and expectations for each committee, and providing them the support and resources required to accomplish their missions. These committees will gather and develop much of the information needed for the Administrative Articulation Agreement. They also should make recommendations to and work closely with the Implementation Committee. (The chairpersons of these committees could meet on a regular basis as members of the Implementation Committee.)

Other early tasks of the Implementation Committee include:

- determining the primary goals and objectives of the consortium,
- preparing a mission statement,

- establishing working definitions of key terms (such as *articulation, 2+2, 4+2,* and *tech prep*) as they will be used by consortium members,
- identifying the basic employment needs of the community and the related job skills required, and
- determining the readiness (level of understanding and acceptance) of the members of the educational institutions and business, industry, and labor organizations to commit to a TPAD program.

In addition, this committee might consider the need to include a middle school (junior high) career-exploration component and/or recommend doing away with the general-education program.

As planning and development proceed, the Implementation Committee, working with the Curriculum Development Committee, must:

- develop guidelines, procedures, and cooperative agreements for establishing articulation programs,
- determine which curricula to articulate between which institutions,
- determine which institution will offer which specific courses,
- establish a schedule for development of articulated courses and curricula,
- coordinate the school calendars of participating institutions, and
- anticipate the specific turf issues and local problems that need to be identified and negotiated (see chapters 5 and 10 for possible areas of concern).

The Implementation Committee has general administrative responsibility for locating and distributing resources, coordinating all activities between institutions and organizations, and moderating and resolving any disputes. The committee should also:

- determine inservice training needs and see that appropriate training is provided,
- see that appropriate counseling services are provided,
- see that appropriate promotional materials are developed and distributed, and
- see that evaluative data are collected and processed.

Finally, the Implementation Committee is responsible for developing the Administrative Articulation Agreement between the institutions and organizations. The Administrative Articulation Agreement should be reviewed annually and modified as needed.

(See appendix C for sample copies of Administrative Articulation Agreements.)

The Implementation Committee will probably need to meet on a monthly basis during the first year (planning) or two (implementation). They may need to meet even more frequently during the first three to six months.

Curriculum Development Committee

The Curriculum Development Committee has the basic responsibility for changing the curricula. Its job is to:

- review the needs of the community,
- review the current curricula,
- identify and do away with duplication,
- modify courses, as needed, and
- develop new courses and/or curricula, as needed.

The Curriculum Development Committee should consist of both academic and vocational faculty, along with curriculum specialists from the secondary and postsecondary educational institutions; second-level administrators from business, industry, labor; and appropriate representatives from other local organizations. It is vital that members of this committee be respected and recognized as leaders in the local institutions and organizations, especially by the faculty of the local educational institutions.

The members of this committee must maintain constant communication with the faculty of the member institutions and make certain that they seek, listen to, and respond to their input. In addition, they should be actively involved, along with the Implementation Committee, in the design and development of inservice workshops to orient teachers to the new curricula. After all, if teachers don't believe in and commit themselves to the changes being made, the "new curriculum" will be just another passing fad that is never implemented properly.

It is important that the chairperson of this committee be a leader recognized by the faculty of both secondary and postsecondary institutions—preferably a dean, department chair, or central office curriculum specialist with extensive curriculum and teaching experience. This person should have strong administrative skills and an understanding of curriculum development. And, like the chairs of other committees, this person should combine a clear vision of the overall program with an understanding of what needs to be accomplished and the ability to communicate with, motivate, and support committee members.

Most teachers carry a very heavy workload and are constantly being asked to do more, frequently with fewer resources. To the degree possible, faculty who are directly involved in redesigning and/or developing curricula should be given released time or special summer contracts. Where major curriculum redesign is involved, significant budget allocations should be sought.

The Curriculum Committee should assist the Implementation Committee in determining the employment needs of the community in order to determine the adequacy of the current curricula. These efforts should begin with a survey of the local job market. This survey should look ahead to identify future needs as well as current ones. Identifying future needs requires more effort and will not be accomplished through a typical mail survey. It may require some research, along with selected interviews with progressive business and industry leaders. The involvement of local business, industry, and labor representatives in designing and conducting such a survey is helpful not only for the information they provide, but also for the support they can give to the total TPAD program. (They may subsequently provide mentoring, appropriate part-time employment, and possibly scholarships.)

The job-market survey will help the Curriculum Development Committee identify future as well as current employee skills and abilities. The current curricula should then be examined to determine if they train to these identified skills and abilities. If they do not, then courses or even entire programs will have to be revised, added, or deleted.

During the process of reviewing and revising the curricula, it is important to take the concept of articulation seriously. Articulation means that the secondary and postsecondary curricula are *joined* in such a way as to make the *total sequence of courses a functional whole*. Articulation requires more than the higher levels dictating prerequisites or standards to the lower level. Secondary and postsecondary representatives of the Curriculum Development Committee must keep the goal of an articulated program in mind throughout the whole process. They must review all pertinent curricula—both high-school and college components—and *make appropriate changes at both levels.*

Prior to identifying specific curricula to be articulated, many questions need to be answered. They include:

- Will the articulated courses be competency-based?
- Will the articulated curricula incorporate applied academics?

- *Will the articulated curricula* be single programs (e.g., drafting) or career clusters (e.g., engineering technology)?
- Will the articulated curricula incorporate a career-ladder concept?
- Will the articulated curricula be advanced-placement (time-shortened) or advanced-skill programs?
- How long will advanced placement be accepted by the receiving institution?
- Will the articulated curricula be 2+2 or 4+2?
- Will a middle school (junior high) job-exploration component be added?
- What criteria will be used to determine course competencies?

Validating student competencies becomes a special issue when the postsecondary institution agrees to grant advanced placement and/or college credit for courses students take in high school. (A student may be allowed to skip the beginning course in a program—that is, advanced placement—without receiving college credit hours for the course skipped.) The issue centers around the postsecondary faculty's concern that the high-school course teaches comparable skills, abilities, and concepts and that the level of student achievement attained is comparable to that of the postsecondary institution. There are two primary methods for granting advanced placement in a postsecondary institution:

- the student passes an exam developed and administered by the postsecondary faculty, or
- the postsecondary faculty reviews the instructional materials used and the skills/abilities/concepts taught at the secondary level and determines they are comparable.

The second approach certainly indicates a closer working relationship and a higher degree of cooperation and trust between the faculties of the secondary and postsecondary institutions. The method for awarding advanced placement should be resolved by the Curriculum Development Committee.

Major institutional changes require careful planning and take time. A minimum of one year should be allotted to make basic curriculum changes. However, the overall process may take an additional one to four years, depending on the number of curricula that are being changed and the degree to which each is being rewritten.

It is typical for faculty from the secondary and postsecondary levels to be suspicious of each other and protective of their own turf. It takes time and experience with each other to build confidence and trust. It is a good idea, therefore, that the Curriculum Development Committee start "where they are"—tackling the easiest curricula first and working with the faculty in departments that indicate they are ready and want to change. (Schools that already have some cooperative ventures have a distinct advantage in this regard.)

There are three typical levels/stages of TPAD program development. The committee may choose to review the total curriculum and:

- eliminate duplication. No courses are modified or added.
- modify courses to add or delete competencies and add or delete courses as required.
- do a total rewrite of the curriculum.

In developing the curriculum, it is important to remember the distinctive characteristics of a TPAD program. It should lead to an associate degreee or two-year certificate. It also should be competency-based; the curriculum should be based on a career cluster (where appropriate) with an applied-academics core, and a career ladder should be built into the curriculum when possible. Where the job market requires technicians with advanced skills (master technicians), the curriculum should be of the skill-enhanced rather than time-shortened mode.

The Curriculum Development Committee will probably need to meet once or twice a month during the first year or two. Then it should continue to meet, as needed, over the two to five years it may take to finalize the curricula for the TPAD programs.

Information/Promotion Committee

As mentioned earlier, major changes must occur in our educational programs to meet the needs of our changing society. The TPAD program can be a major element in bringing about needed changes. But this means that a new vision with new information, benefits, approaches, and values must be marketed to school administrators, faculty and counselors, students and parents, local businesses and industries, local governmental agencies, and the public in general.

Marketing is the primary responsibility of the Information /Promotion Committee. This committee is the one that will be responsible for:

- developing the marketing plan,
- developing appropriate information and promotional materials, and
- seeing to it that the message is delivered effectively and appropriately.

(See chapter 8 for a detailed description of a possible marketing plan and related promotional approaches.)

The Information/Promotion Committee should consist of counselors from both the secondary and postsecondary educational institutions, public-information specialists, and representatives from the local news media, business, industry, labor, and other local organizations. Because committee members may also be key persons in delivering the materials and making presentations to various audiences, speaking ability, writing skills, and personal "presence" may be a consideration in choosing some members.

The chairperson for the Information/Promotion Committee should be someone who is experienced in the development and dissemination of public-relations materials—preferably, someone currently employed in such a position. He or she may be an employee of one of the educational institutions, a representative of business or industry, or a local news "personality." This person should have strong administrative skills and an understanding of promotional-material development and dissemination. He or she, like the other committee chairpersons, must have a clear vision of the overall TPAD program, an understanding of what needs to be accomplished, and the ability to transmit these to the committee members. High expectations and the ability to support and motivate the committee members also are important.

In developing a marketing plan it is important to target the distinct "audiences" that need to be reached, emphasizing those TPAD benefits that are most likely to appeal to each. The basic message may be the same, but the details, the packaging, and the delivery should suit the specific group being addressed.

Marketing tools that can help promote TPAD include pamphlets, flyers, brochures, newsletters, posters, tape/slide shows, videos, and news releases. Also helpful are special presentations, orientations, workshops, on-site visits to schools and business, and career fairs. Whatever tools are used, it is important to develop an effective logo and use type and color consistently across all promotional materials in a way that builds quick recognition and projects a positive image.

The business community can help significantly in promoting a TPAD program. Not only can representatives of business and industry help identify job skills needed and employ the graduates of a TPAD program; they can also participate in a mentoring program (see chapter 8) and help establish a scholarship fund for the postsecondary component of TPAD program.

The school counselor's office is a primary place where TPAD will be "sold" to students and parents. Special consideration, therefore, should be given to development of a student handbook, counselor's handbook, and other materials for counselors to use (see chapter 8).

The Information/Promotional Committee must have money budgeted for the development and reproduction of promotional materials and the student and counselor handbooks. Donations and volunteer help may supplement the effort, but they will be inadequate to conduct an effective publicity program.

The Information/Promotion Committee needs to meet monthly during the first year or two. However, it should plan to continue meeting, as needed, until the TPAD program is well established in the community as well as in the schools.

Evaluation Committee

Planning and evaluation are two parts of the same process. The primary responsibility of the Evaluation Committee is to gather and process data that will assist in improving the process and products of the tech-prep program. More specifically, the evaluative data should be used to assess:

- the need for the program and the clarity of the problem statements and program objectives,
- the degree to which the program is being implemented as planned, including both timeliness and achievement of events and activities,
- the degree of completion and quality of projected products, and
- the degree to which program outcomes are being achieved.

Such information is vital to those planning and implementing a TPAD program. It is the basis on which improvements can be made.

The Evaluation Committee should work closely with the other committees in collecting data and reporting results. Evaluation should be involved in every step of the planning, implementation, and ongoing operation of the TPAD program. Evaluation activities should provide constant feedback (formative evaluation) so that adjustments can be made as needed. Outcome (summative) evaluation also is important, but it is of little value if it comes too late to make corrections. In essence, this committee should monitor the activities of the TPAD program and provide ongoing feedback in a constructive, useful manner.

Membership on the Evaluation Committee should consist of representatives from secondary and postsecondary institutions (evaluation specialists; central-office administrators; deans or department chairs); business, industry, and labor (second-level administrators); and other local organizations (officers or second-level administrators). It is important that one or more of the members be knowledgeable and experienced in program evaluation.

The chairperson should be particularly strong in program evaluation and have strong relational skills. He or she will need to work harmoniously with the other committees and at times will be called upon to express criticism in a positive, useful way. The chairperson should have a clear vision of the overall TPAD program, an understanding of what needs to be accomplished, and the ability to transmit these to the committee members.

Most of the information (data) that needs to be collected is not of a complex nature, and the processing of this data does not require sophisticated statistical manipulation. Evaluation begins with identifying the unmet educational needs and stating them clearly. Then the committee should formulate objectives that reflect the actions and activities (process objectives) required to meet these needs and the outcomes and/or products (outcome objectives) that are expected to result.

Questions reflecting the kinds of data to be collected should then be framed. Some questions may focus on the degree to which:

- the stated objectives were achieved,
- planned activities were implemented,
- the planned outcome and/or products were achieved, and
- the participants, recipients, and/or producers were satisfied.

Other questions may focus on the numbers and percentages of students (1) enrolling in courses or programs, (2) completing them, and (3) going on to higher education or being employed in their area of training. Satisfaction of teachers, counselors, students, and employers is also important to assess. Special studies might focus on how various learning and teaching styles (for example, applied academics) relate to student success. Also, long-term tracking of students (if affordable) will provide very meaningful data.

Of course, basic to the success of any curriculum is measuring the degree to which students, individually and collectively, achieve the stated competencies of each course and of the overall programs.

Collecting and processing evaluative data involve:

- developing an evaluation design or plan,
- developing data-collection instruments and processes,
- collecting the data,
- processing the data, and
- reporting the results in a manner that is useful to those running the TPAD programs.

Collecting and processing data require the expenditure of resources. This function, therefore, will require budgeting of staff and money to cover printing, data collection, data processing, and reporting. However, if data collection and evaluation are done carefully, the cost will be minimal and far offset by the gains in improved programs.

The Evaluation Committee should be formed early and work closely with the Implementation Committee during the planning process. They should continue to meet to oversee the development of the evaluation design and instruments, the collection and processing of the data, and the reporting of the results with recommendations. This committee will probably need to meet on a monthly basis for the first year or two, then as needed.

DEVELOPING STAFF

Staff development is basic to the success of any institutional change process. The greater and more significant the change required, the more important the amount and quality of staff development becomes.

Three types of staff-development activities are recommended:

- state or regional conferences and workshops,
- local inservice workshops or orientations, and
- ongoing networking and sharing.

State/Regional Conferences and Workshops

Where possible, state or regional conferences and/or workshops should be conducted. Primary focus should be for those planning TPAD programs or in the early stages of implementation. All of the topics covered in this book are appropriate for inclusion in such gatherings, including:

- basic concepts and definitions on which the TPAD programs are built,
- the planning process,
- tasks and responsibilities,
- successful examples to which participants can relate,
- curriculum issues involved in various approaches to TPAD,
- counseling issues,
- promotion and marketing ideas, and
- program evaluation.

Typically, TPAD workshops attract educators from the interested secondary and postsecondary institutions. They are important to the success of any TPAD program. However, it is also important to involve representatives from business, industry, and labor, to the degree possible. Without their involvement, TPAD programs may be training employees who do not have the skills employers need.

The state/regional conferences and workshops should also be designed to encourage networking and sharing by the participants after they return home. Circulating lists of participants and providing free time at the meetings for participants to get to know one another help. Follow-up meetings among participants from a certain area may also be scheduled.

Sample materials, checklists, and other general information should be provided to participants so they can refer to them after they get home. If possible, materials should be supplied that can be used for conducting local inservice workshops.

Local Inservice Workshops

Local inservice orientations and workshops are critical for providing information to and gaining the support and commitment of those who must develop and implement TPAD programs. The types of information presented at state or regional conferences should also be covered in the local meetings. Persons going to state/regional meetings are typically seeking information. However, local inservice must go beyond providing information; it also must move into the "how to" and begin to involve participants directly in the planning process and in decision making. Outside consultants who are knowledgeable and experienced may be called upon to plan and/or conduct the inservice training.

Prior to setting up the various committees, inservice meetings should be conducted that include administrators, faculty, counselors, and local representatives of business, industry, and labor. Whenever possible, secondary and postsecondary inservice meetings should be held together. Cooperation and trust among and between these groups are critical to success. Common orientations and personal, direct contact all contribute to this end.

Special inservice, focusing on aspects of TPAD, may also be provided separately for administrators, teachers, and counselors. Again, when possible, it is desirable to bring secondary and postsecondary groups together.

In addition to inservice meetings, it is important to keep all members of the institutions informed and involved on an ongoing basis. Provide them information; seek their input.

Networking and Sharing

Critical to the success of any business or industry are employees who can work harmoniously in teams to solve group problems and who can be responsible for checking the quality of their own products/services. The survival of the American standard of living is said to rest on the degree to which education produces such employees. If educational institutions are going to produce such employees, educators and employers must model such behavior as well as teach it.

Several considerations affect sharing and networking among those implementing TPAD programs. First, it should be kept in mind that TPAD is based on an articulated curriculum. This means that administrators, faculty, and counselors from both secondary and postsecondary institutions must work closely together in reviewing and modifying the total curriculum. They should also involve local business and industry, labor, and civic and governmental organizations. This ongoing team effort is critical to the success of the TPAD program and to the restructuring of education.

It also is possible for secondary and postsecondary institutions to share facilities, equipment, and faculty. This is not uncommon and can be advantageous to all involved. Sharing resources builds upon and takes advantage of the strengths each may have to offer as well as giving an opportunity for ongoing communication.

The local TPAD consortium should identify and seek out other TPAD consortia in their region or state. On-site visits between consortium members and joint meetings and/or inservice sessions can be very productive. The exchange of materials as well as experiences will be beneficial to all concerned. It also will provide the opportunity to discuss the possibilities of horizontal articulation across consortia.

On the national level, at least two federally funded programs are collecting information about TPAD and other articulated programs and can be valuable networking resources. The National Center for Research in Vocational Education (NCRVE), University of California at Berkeley, maintains a national database on articulated and TPAD programs. The National Network for Curriculum Coordination in Vocational and Technical Education (NNCCVTE) collects and loans out curriculum materials. NNCCVTE has established a special category of curriculum materials on TPAD and other articulated programs.

Both of these organizations provide information and materials upon request. However, their database and materials collection will be only as good and thorough as the cooperation they receive from the field. Sharing and networking must always be an interactive process. (See Resources section for addresses of these programs.)

Sharing and networking are basic to the development, implementation, and operation of TPAD programs. To the degree that educators reach out—not only to each other but also to business, industry, labor, and the general public—TPAD programs will be a success and we all will win.

5

SMOOTHING THE ROUGH SPOTS

Identifying Issues and Overcoming Obstacles

Cliff Belcher

No program develops without difficulties, and TPAD programs are no exception. People problems, policy challenges, and funding dilemmas will all place obstacles in the path of successful development. Nevertheless . . . TPAD programs work. Issues can be resolved and obstacles overcome. And the reward for the work involved in overcoming the difficulties is a strong, smoothly functioning system that fulfills the expectations of all involved.

5

When an innovation is proposed in education, educators typically think in terms of issues and obstacles. Is this just another fad, they wonder, or is it really a creative approach to providing better-educated youth and adults? School administrators, both secondary and postsecondary, imagine the difficulties involved and wonder whether these barriers can be overcome in order to apply the innovation in real-life situations.

The introduction of the Tech Prep/Associate Degree (TPAD) concept is no different. One of the major steps in implementing a TPAD program, therefore, is to identify as succinctly as possible the issues which will be faced and to outline strategies for overcoming any obstacles that might exist.

Sometimes the difficulties that are raised have no easy answers and no simple solutions. However, if a local public-school system and a postsecondary institution are committed to implementing a TPAD program, the difficulties can be overcome.

Public secondary and postsecondary schools in North Carolina have proven this. Since the launching of a single project in Richmond County in 1987, TPAD programs have proliferated in the state. Approximately 30 percent of the local school systems and almost one-third of the community-college institutions have committed to TPAD programs and are in either the planning or implementation stages. Many others are beginning to plan and are waiting for resources. By 1992-93, it is projected that 100 of the 134 local school systems and 44 of the 58 community-college institutions will be at some stage of involvement with the TPAD program. This success has been built on a strong base of articulation between the public schools and community-college system over the past twenty-five years.

IDENTIFYING ISSUES

Studying the successes and failures of other TPAD efforts should assist in identifying mistakes to avoid and potential issues to be confronted. Because these issues normally will be numerous, the first decision by administrators who propose to implement TPAD should be to allow at least twelve months to conduct research, identify the issues, and address as many as possible prior to implementation.

This may seem like a lot of time. However, as the following issues are reviewed, the need for it becomes obvious. In the North Carolina systems that used this approach, implementation has gone much more smoothly than in those systems that did not provide enough time.

This chapter will by no means address all the issues that public-school systems and postsecondary institutions will encounter as they work to make TPAD a reality. The TPAD concept proposes a major reorientation and restructuring of the public-school system and, in some instances, the postsecondary system. All of us know that such a major change does not occur overnight or without problems. The importance of planning and patience, therefore, cannot be overemphasized. Many different groups of people must become informed about TPAD and committed to it if the program is to work.

Generally, issues and obstacles arise in four major areas:

- people,
- policy,
- operations, and
- resources.

Before any of these issues can be addressed effectively, it is necessary to have a proposed model for how the TPAD program can work. This model can be one in existence elsewhere or one designed by the local community. The examples outlined in this book are an effective place to start.

PEOPLE ISSUES

Normally, people issues are the trickiest and the most important ones. In North Carolina, the success of TPAD programs depended to a large extent upon the willingness of everyone involved to understand the concept and cooperate with the necessary changes. In general, people issues involve either:

- *understanding of the program*
  — the philosophy of education underlying it,
  — the changes it will entail,

— the concepts that shape it—or

- *support for the program*
  —from administrators and policy makers,
  —from school personnel,
  —from employers, parents, and students.

Synchronizing Philosophies of Education

Philosophy of education is a very significant issue to secondary-school educators and the general public as they are brought into the TPAD effort. They are likely to question just what education is supposed to accomplish—and whether TPAD can accomplish it. The general belief is that schools should be actively involved in providing students with a well-rounded academic and cultural foundation. In many instances, that means preparing for the university setting. Many people question whether education should direct its efforts toward preparing students to meet businesses' needs or requirements. And that, unfortunately, is an interpretation placed upon TPAD by many secondary-school educators.

Interestingly, when educators and others are led to discuss this matter in depth, they usually discover that their philosophy of education and the TPAD concept are not that far apart. Business and industry are saying they need people who have adequate knowledge and skills to change as needs change, think independently, and make decisions. These are the skills needed by all students. When educators come to understand that TPAD's purpose is to do just that, one obstacle is eliminated.

It is vital to allow adequate time for those involved to work through this issue. This will usually take more than a single session; several may be needed. Until this barrier is hurdled, however, a local school system need not bother proceeding. Gaining a commitment to TPAD is not something that can be accomplished through administrative edict.

One technique that can be used in winning educators over to the TPAD philosophy of education is for employers who are recognized as leaders in the community to meet with the school personnel to explain the employment crisis for the community and the positive economic impact a program like TPAD can have on the total well-being of the citizens. Tours of local businesses and industries can also help. Few educators have had the opportunity to view the integral workings of a local industry or observe the rapid transitions in workplace technology. Talking with employers and touring employment facilities can help educators realize that eventually most students will seek employment and that a high-school education alone may no longer be sufficient. They also can be assured of the employers' commitment to support them in their TPAD efforts.

While postsecondary educators are more likely than their secondary-school counterparts to understand and accept the TPAD philosophy, they still may have questions and misconceptions. Information and education efforts, therefore, should not neglect teachers, counselors, and administrators in postsecondary institutions. As members of the community and as staff members of the proposed cooperating postsecondary institution, these persons need to be knowledgeable so they can competently explain and enthusiastically support the local TPAD initiative.

UPGRADING ATTITUDES

This issue is closely correlated to the philosophy issue. The success of any TPAD program depends on the attitudes of those involved in implementing it. Possible attitude barriers or obstacles, therefore, should be identified from the outset.

1. *Attitude Barrier #1: Teachers' Concern for Their Jobs.* Experience has shown that the first concern of school personnel, especially teachers, when confronted by the possibility of a TPAD program is whether their program and/or job will be eliminated. This is understandable because of the significant changes required to institute TPAD and the heavy emphasis on accountability for students' academic improvement.

In North Carolina, high-school vocational education teachers were particularly concerned because North Carolina's approach to TPAD included advanced academic and vocational skills. Teachers were assured they would not lose their jobs. They were advised, however, that some programs, courses, content, and methodology would need to be added or changed in numerous areas—academic and vocational.

2. *Attitude Barrier #2: Teachers' and Counselors' Unwillingness to Change.* This brings us to the second strategic point concerning attitudes—the willingness of school personnel to change. This is especially true of teachers and counselors. If teachers' program thrusts are not in sync with the total effort, then the students lose the benefit of a unified, well-articulated program. If counselors do not see the value of the program, they will steer students in directions other than TPAD. Obviously, both of these attitudes can be real detriments to both the students and the program.

In North Carolina, if an educator persisted in resisting the changes necessary to implement a TPAD program, then the only recourse was to find someone else who was more sympathetic to the program's concepts. Fortunately, there have only been isolated cases of this. Most educators, when allowed adequate time to adjust, are eventually won over to TPAD.

3. *Attitude Barrier #3: Low Expectations for Students.* It is vital that those involved in implementing a TPAD program believe all students are capable of learning and not prejudge a student's ability before that individual is challenged. Unfortunately, too many teachers have low expectations for certain students—especially those in traditional vocational education—and those students therefore remain unchallenged.

Instead, expectations must remain high, even if it becomes necessary to try different methodologies or allow more time for accomplishment. Even with students who may not achieve at the highest expectation level, the very act of striving for that goal will result in a better education. This has proved true again and again in North Carolina's TPAD experience. When teachers raised their expectations for students, students responded.

Counselors' expectations for students are just as important as teachers' expectations. It is important that counselors learn the potential that TPAD programs provide for students to succeed both in school and on the job. Counselors can and should be TPAD's greatest advocates both in recruiting students and retaining them in the program.

4. *Attitude Barrier #4: Concern That TPAD Would Steer Students away from Higher Education.* In North Carolina, interestingly enough, while most of the potential barriers in attitude had to be addressed within the public schools, there was one concern that arose at the postsecondary level. Educators at technical, community, and junior colleges wondered whether the increased effort of improving academic and technical achievement in high school would preclude the need for students to pursue advanced education immediately after graduation. Such misunderstandings are a major reason for talking through TPAD with everyone concerned.

Growing Vigorous Tech-Prep Programs[1]

Vigorous, bountiful tomatoes do not grow overnight. They rarely grow in poorly prepared soil. If you ignore the environmental factors, the tomato vines will wither and die with no yield. They must have the proper moisture, sunlight, temperature, cultivation, and nutrients to flourish and produce tomatoes of which you would be proud. Of course, you must start with quality seeds and be committed to a bountiful yield. Developing vigorous tech-prep programs is similar to growing quality tomatoes.

The Seeds	Successful tech-prep programs begin with someone planting a quality seed. That seed may come from a state or local administrator, a counselor, principal, teacher, business/industry representative, or community-college person. It matters little who plants the seed. However the seed's hull must reflect the goals of better preparing students for tomorrow's world. It must reflect the attitude of expecting more from students. It must reflect a future's orientation, not curriculum, instruction, and guidance as usual. The person who plants the seed must be willing and able to "afflict the comfortable" (Frosty Troy, OK). That person must be willing to carry the message—"We have miles to go before we sleep." Sometimes, you must be a *pest* to get the attention of those who must make changes.
Commitment	Commitment evolves from involvement. Commitment comes when you develop a vision, the goals, a strategic plan, and a database about the success and failure of the local education system. You must involve the stakeholders in every step of the process as you develop these components. You must have commitment from the top level of administrators at the high-school and community levels. You must have commitment from key business officials and community leaders.
The Soil	Poorly sequenced, out-of-date course content must be eliminated. In their places, you must put fertile, up-to-date programs capable of providing rigorous courses of study. Teachers must be given the responsibility to make changes and to report to the administration the results of their work. You must help them in finding out about what changes are needed. You must provide time for teachers to serve internships in business/industry, visit model programs, and work cooperatively with business/industry and community-college instructors. You must make believers out of doubters by illustrating the necessity to change, upgrade, and increase thinking-skills instruction. Staff development is critical to preparing the soil.

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[1] Excerpted from June Atkinson, "Growing Vigorous Tech-Prep Programs: A Process, Not an Event" (Report prepared for Southern Regional Education Board Basic Skills Meeting, September 1990).

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The Environmental Factors

You must create an environment where parents, business/industry personnel, and students know about the program. You must focus the "sunlight" on marketing, publicity, and presentations to anyone willing and able to listen.

You must feed the faculty and students with the nutrients of rewards, recognition, higher expectations, and individual attention.

You turn up the temperature when expectations are not being met by having individual conferences. You must find out why some aren't being successful and give them special help.

You must create an atmosphere of cooperation, not competition, among the faculty. You must expect them to meet greater outcomes with student performance. You must have accountability.

And...

Just when you are satisfied with the yield, you start again, renew the effort, and "afflict the comfortable." After all, tech prep is a process of school reform. It's not an event.

June Atkinson

Postsecondary educators need to understand that one of TPAD's purposes is to encourage more students to pursue advanced-skills training in postsecondary institutions and to smooth the secondary/postsecondary transition. However, everyone must realize that a certain segment of every high-school graduating class will elect to proceed directly into the workplace. It is equally important that these students have the very best education possible from the schooling they have received.

Overcoming these possible attitude obstacles calls for an extensive staff-development effort in both secondary and postsecondary institutions. Adequate time must be allowed to accomplish this both before the instructional phase of the TPAD program gets underway and after it has begun. Such allotted time will pay for itself a hundred times over in terms of improved relationships, higher staff morale, and increased productivity for everyone involved.

Eliminating Misunderstanding About TPAD

An understanding by educators of the basic concepts underlying TPAD is extremely important to TPAD's success. Teachers, counselors, and administrators must be convinced that the TPAD option will move the majority of students from a general program to a more upgraded, sequenced program of education—a strategic move to eliminate the possibility of students "wandering" through their school years without a focused goal.

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Educators must also understand that TPAD is a legitimate parallel to the college-preparatory program. Initially, many educators, especially those in the academic arena, perceive TPAD as a gimmick designed to "save" vocational and technical education. They do not perceive it as a legitimate alternative to college prep, one that will increase the knowledge and skills of a greater number of students. This misperception represents another potential barrier which must be addressed.

The term *tech prep* itself can be an issue. Most educators are conditioned to think in terms of a university education, and "tech prep" may seem to imply something less. Many confuse it with apprenticeship training as commonly practiced in Europe. This myth must be eliminated. TPAD and apprenticeship education are two distinct options, each with positive features and some similarities. (Refer to the technical education plan illustrated in the preface.)

Some teachers even feel that TPAD will lower scores on national tests. The TPAD program in Richmond County, North Carolina, which has been in existence the longest, has proven this concern wrong (see Douglas James' contribution to chapter 6).

Some postsecondary staff express concerns that students educated through the TPAD program will not have sufficient knowledge and skills to perform in college courses. This concern can best be allayed by thorough articulation of course competencies. This can be a time-consuming process in the planning stages of TPAD development.

It is important to remove as many myths about TPAD as possible. This can normally be accomplished by having secondary and postsecondary staffs work in "quality circle" task forces on a weekly or bimonthly basis. Articulation simply will not work unless the two staffs, from the superintendent and president to the instructional front line, are conversing frequently.

School Administrative and Policy Support

Key to the success of any new thrust, whether in business, education, or government, is the total *commitment* and *involvement* of those in leadership positions. Without top-level support, the effort will soon diminish.

This has certainly proved true of North Carolina TPAD efforts. The most successful TPAD programs have been those in which the superintendent of the local school district and the president of the cooperating community college have provided visible and verbal leadership to the program. This leadership has been undergirded by the superintendent's board of education and the president's board of trustees in both policy formulation and implementation. Being the ultimate authority figures for this level of education in the local area, these individuals and policy bodies must not just approve the concept, but also be seen as front-line advocates. Experience shows that when upper-level administrators simply endorse the concept and then relegate its implementation to a second- or third-line administrative level, TPAD implementation is slower and sometimes less effective.

This does not preclude the reality that, once leadership has been clearly established, many responsibilities can be delegated to others within the structure. In North Carolina, the local director of vocational education, in many cases, has received such responsibilities. And while vocational education was a dominant force in the advancement of TPAD, such assignments have not been without their concerns. For one thing, the local director of vocational education does not usually have administrative authority for academic teachers. Also, delegating TPAD to a vocational director lends support to the belief that TPAD is just another voc-tech program.

This is an issue that needs to be discussed in each locale. In deciding who will hold primary administrative responsibilities for TPAD programs, it is important to remember that TPAD is a total effort that requires students to participate in grade-level or higher academics and vocational/technical courses. With this in mind, school administrators should decide the most appropriate level of administration at both the secondary and postsecondary levels for designated responsibilities and tasks. In some instances, it may be appropriate for multiple levels of responsibility to be assigned.

Another key administrator is the high-school principal. If this person, as the educational leader for that school, is not committed totally to TPAD, all efforts will fail. The principal must be the motivating force for counselors, teachers, and other support personnel. For this reason, the principal and his/her staff must feel total ownership to the program.

Teacher/Instructor/Counselor Support

As already indicated, if TPAD is to work, it must be supported by all personnel at the secondary and postsecondary levels. This support only comes when all individuals have an adequate understanding of the TPAD concept and their place in a TPAD program and feel a sense of commitment—that is, when they develop a sense of ownership. Here again, it is vital to set aside adequate time at the beginning of the process for this to happen.

One of the better techniques for promoting individual ownership is for the superintendent and president to meet jointly with the secondary and postsecondary staffs to explain the concept, to make clear the commitment of top leadership, to emphasize clearly the expectations for all, and to describe a strategy for accomplishing the task. Time must be set aside for questions and answers—and for staff members to work through this new challenge both personally and professionally.

The process of developing staff support should include preparation sessions in which secondary and postsecondary staffs meet both independently and jointly to identify questions or needs. These can then be addressed by top-level administrators or, preferably, by the staff members themselves. Once questions have been answered and concerns met, the staff members charged with drawing up a plan for implementing proposed changes can begin their work.

The role of the counselor is critical in both the planning and implementation stages of a TPAD program. Counselors must begin talking to students about TPAD as early as the middle grades. In order for students to take advantage of applied-academics programs and to allow for the appropriate sequencing of courses, preparation and planning for high school should begin no later than the seventh or eighth grade.

Although some will complain that this is too early to start "tracking" students toward a career, the concept is no different from what is currently being done for college-preparatory students. Its primary purpose is not to *lock* a student into a specific career, but to have that individual educationally prepared for whatever direction he or she takes after high school, be it work or further education.

Employer Support

One of the very critical issues to be addressed early in the implementation of a TPAD program is employer support. Local businesses and industries will need to be vital partners in the TPAD movement—not just because they need well-educated employees, but because of the potential this creates for the community in terms of social, economic, and cultural advancements. Appropriate involvement of local employers will provide the two systems of education with human and financial resources and help with marketing the TPAD program.

It is important that individuals from the employment sector be brought into the initial discussions when a local school system and a postsecondary institution are considering a TPAD thrust. They should also be partners through the entire process, serving on committees, contributing support, mentoring students, and participating in intern programs. Failure to seek such participation will have a devastating impact on the total effort.

Parent Support

A question that should be asked early in the development of a TPAD program is "Will parents support it?" A positive answer to this question is essential to future success. Because parents usually exercise a powerful influence on their children's choices of courses and careers, it is important that this segment of the local population understand clearly what TPAD is and proposes to do. This means that the community planning team should have parent representatives.

Many of the present parent generation still aspire for their children to attend four-year colleges, although national statistics indicate that the majority of students neither does this nor needs to do so. According to job-market projections, it is important for students to acquire some sort of postsecondary education, but not necessarily a baccalaureate degree. Many job openings now and in the future promise equal success for individuals with an associate degree from a technical, community, or junior college—and such a degree will not prevent an individual from pursuing other degrees if they are desired or needed. Once parents understand these facts, many become more open to the TPAD possibilities for their sons or daughters.

Employers working in partnership with schools can be very effective in helping parents understand the potentials of the TPAD program. Local businesses and industries can conduct meetings in which employees who are parents can receive information on the TPAD program and have questions answered. (The section on marketing in chapter 8 will cover these possibilities in more depth.)

One of the requirements of the TPAD program is a written agreement between school, parent, and student. (This agreement will be discussed in more detail later in this chapter.) If this requirement is to work effectively, parents must support the program. The potential for student success is enhanced when the parent is actively involved.

Student Support

Another vital question to consider in beginning a TPAD program is: "Will students support the TPAD program through participation?" This question requires considerable attention, especially if the local school system is faced with a lot of "Bart Simpson philosophy." The student may respond, "Why should I take more difficult courses? What's in it for me?" This may be one of the more challenging issues that TPAD developers will face.

Without proper guidance and direction, many students will go through four years of high school just doing what is necessary to meet the school's graduation requirement, deliberately choosing nonrigorous courses and paying little attention to how well the courses relate to each other or to the outside world. Dale Parnell refers to these students as the "neglected majority." A 1988 report by the W. T. Grant Commission on Work, Family and Citizenship calls them the "forgotten half."[2] Regardless, their situation is a very serious one. They graduate. To what?

One of the strengths of the American education system as compared to many European systems is that it does not "track" students into a specific educational process. This strength, however, can be perceived as a weakness if the student, not receiving the proper motivation and guidance, is allowed an "easy way out" of high school.

The local school system and the postsecondary institution must respond to this need. Creating expectations or coercing students into specific curricula is not enough. Following the philosophy of this nation's competitive enterprise system, local education systems and postsecondary institutions must include—in addition to high expectations—effective inducements, incentives, and rewards for students to take TPAD and succeed.

One such inducement is helping students understand the world they will enter upon leaving the public-school system (either as early leavers or as graduates). While this task can begin as late as the middle-grade years, it appropriately should start in the primary and upper-elementary grades. At the middle- and high-school levels, educating students about the outside world can be done effectively by providing them with appropriate reading and visual materials, inviting employer representatives to visit the school and speak frankly with students, and providing for students to go on-site to local businesses and industries to see firsthand the jobs that are available. These types of activities reinforce the importance of advanced academic and technical knowledge. Shadowing, internships, and actual work experiences in businesses and industries also help awaken the students to the need for adequate education.

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[2] *The Forgotten Half: Non-College Youth in America* (Washington, D.C.: Youth and America's Future: The William T. Grant Commission on Work, Family and Citizenship, 1988).

There are numerous incentives that schools and employers can offer to attract students to TPAD programs. Some schools establish special recognition programs and/or give weighted credit for the more advanced courses. T-shirts or insignias can be designed and distributed to participants. Local employers can offer summer employment to students who excel at a prescribed level or can promise higher beginning salaries to those who complete TPAD programs. The potential is almost unlimited when those in the community think creatively.

Likewise, there are many reward systems which can be put into place. In North Carolina, one outstanding effort by Sandhills Community College Foundation in Moore County has been to award all-expense-paid scholarships (tuition and books) to any students who satisfactorily complete the high-school tech-prep program and elect to enroll in an associate-degree program at Sandhills Community College. The foundation funds this effort through holding golf tournaments and similar events; local employers have also contributed to the fund.

POLICY ISSUES

Philosophical and policy considerations are foundational to resolving issues and overcoming obstacles. TPAD developers must make some basic "who, what, when, where, and why" decisions. These decisions in turn will shape the way people, operational, and resource issues are handled.

Turfdom

Turfdom is really a people issue, although resolving it is a matter of policy. In education, as in most endeavors, change often causes the people involved to take a regressive posture—to fight to preserve what is theirs, including their power and authority. TPAD developers should recognize and prepare for this natural tendency.

In a TPAD situation, turf issues usually center around these questions:

- What should be taught?
- Who should teach what is to be taught?
- Where is this to be taught (i.e., what institution should offer it)?

Turf problems can sometimes be created by funding formulas. For example, both the high school and the community college need to generate ADA (average daily attendance), ADM (average daily membership), or FTE (full-time equivalence) enrollment in order to receive funds. They may therefore compete with one another for students. If so, this is a policy matter which needs to be addressed.

In North Carolina, both high schools and postsecondary institutions receive funding for the time they have the students. For example, if a student remains at the local high school for more than half the school day, the local school system gets full ADM credit. The postsecondary system receives funding on an FTE formula basis. Each school, therefore, wants to keep students on campus as much as possible.

Since turf issues can be so sensitive, it is important that they be resolved with the input of everyone concerned. The TPAD model that has been selected will provide some guidelines for answering the questions of who teaches what, and where, but details must be worked out through a process of give and take.

It is especially important that the process for deciding turf issues be acceptable to both secondary and postsecondary institutions; this kind of agreement is essential to ensuring smooth student transition between the two levels of education. Both high schools and postsecondary schools must be willing to give up and/or accept responsibility for needed changes.

Decisions on what should be taught were reached in North Carolina through interaction of personnel from the two educational levels. The first step in the process involved determining what kinds of knowledge and experiences a student should acquire in order to succeed in a technical associate-degree program. It was immediately recognized that, whereas a prescribed level of academic achievement was necessary and basic, the particular model being used would be enhanced by development of selected vocational/technical skills in the three areas of engineering, health/human services, and business. It was also determined that, in order for the desired academic skills to be achieved, a 4+2 model (grades nine through twelve, plus two years postsecondary) was needed in lieu of a 2+2 one.

The question of "Who should teach what is to be taught?" was resolved by agreeing that the secondary school should accept full responsibility for teaching all the desired preparatory courses to the extent of the system's capabilities (human and financial). Where needed courses could not be provided at the high-school level, alternatives would be pursued, including that of providing them at the postsecondary institution. It is extremely important that this question of who teaches what be addressed, possibly in one of the articulation agreements generated by the two educational levels.

This decision led naturally to resolving the question on "Where is this to be taught?" After personnel reviewed the entire curriculum requirements, all logical courses were assigned to the high schools. Where an advanced academic course or a specific type of vocational/technical course was required that the high school could not provide, the postsecondary institution would provide this instruction. The community-college institution in North Carolina has the flexibility, with local school approval, to offer special courses for high-school students or to enroll those students in regular courses offered by the institution. Based upon local decisions, the student could receive high-school credit only or college credit which could also be counted toward satisfying a high-school credit requirement.

Experience has shown that the North Carolina model provides additional benefits to both institutional levels. In most instances students, having had vocational/technical instruction in high school, are able to enter at advanced levels within the postsecondary technical program.

Several options are available to the postsecondary system when this occurs. One is to provide these students with more advanced-skills courses than are normally provided in the technical associate-degree programs. (This of course means that the postsecondary institution must schedule effectively to teach the additional advanced skills. This can be accomplished through individualized instruction or by allowing the student to take more courses than are otherwise offered.) Another option is to shorten the two-year period for the student to complete the normal program.

One frequent concern about TPAD arrangements is that they involve a duplication of staff, facilities, and equipment. This usually is not a problem unless the postsecondary campus is extremely large or its enrollment is extremely low. It was not a problem in North Carolina. It may become an issue for other locations if the model adopted concentrates solely on providing the academics at the high-school level, bypassing the high-school vocational/technical courses and having all of the vocational/technical instruction take place at the postsecondary institution.

In resolving turf problems, administrators must work with staff in focusing the primary attention on the welfare of the student. Decisions must be made on the basis of what provides the student with the very best educational potential in the most efficient and thorough way? On the whole, this should be the primary concern of educators, and they are willing to accept this responsibility when they are brought into the decision-making loop. In fact, the experience in North Carolina illustrates that through the process of resolving turf issues, educators at both levels not only develop a new appreciation for each other's role, but suggest significant improvements to the process.

There is no magic answer to which institutional level, high school or postsecondary, should teach what to whom. This is a matter of determining what resources are available locally. There will be trade-offs on both sides. Staff should be given the first opportunity to resolve any potential turfdom issues. If they are unsuccessful, then the appropriate administrators can address any pertinent issues through policy directions.

Duration of the Program

As indicated earlier, North Carolina determined the duration of the TPAD program to be six years—four years of high school followed by two years of technical education, a 4+2 model. This model was selected for several reasons. First, TPAD planners wanted to identify a program which would be comparable to, carry the same basic rigor, and generate the same level of prestige as a college preparatory program. Second, they recognized that students must have ample time over the course of their high-school years to schedule the academic and vocational/technical courses they need in order to succeed in a postsecondary technical program. Third, educators hoped to create a different expectation level toward educational achievement among students.

Early planning and preparation are essential in a 4+2 program such as North Carolina's. Students and parents need to start thinking about this option as early as grades seven or eight. This does not mean, however, that students become locked in to the TPAD program. Instead, choosing TPAD actually opens other options to them. The Richmond County TPAD program, for example, identifies several stages in the high-school curriculum where students can transfer into a college-preparatory program. In every case, TPAD students have excelled well beyond what was required by the general course of study.

Of course, the six-year model adopted by North Carolina is not the only possible option. Other national models promote the 2+2 concept or other variations. These options, if selected, may require consideration of a different curriculum structure.

The key to deciding which model is appropriate is to determine the purpose to be accomplished by the structure selected. Some factors to consider are what knowledge and experiences students will need at the postsecondary level and what is already required by the local public schools for graduation. Choosing certain models may mean the local school system must modify its graduation requirements. This decision will likely be affected by whether the school system has a single set of graduation requirements or multiple ones, in which some may not be supported by differentiated diplomas or endorsements.

Another factor to consider in determining the duration of a TPAD program is what should be done with any time saved at the high-school or postsecondary levels through an effective articulation process. Many options are available at each articulation level.

One option at the high-school level is to allow a student early entry into the postsecondary technical program while still in high school—taking one or two postsecondary courses, or whatever the student's schedule will permit. Another possibility is to allow students to co-op (attend needed classes but be relieved part of the day for work-based learning) in one or more areas that fit their career goals. This allows students to determine what skills are needed and whether this is the field they want to pursue. It may also provide funds for eventual tuition and other costs.

On the postsecondary side, as indicated earlier, students could be provided with advanced placement, thereby allowing them to complete the associate-degree program in less than the prescribed two years or, preferably, to enhance their skills by taking additional instruction. Also, if the postsecondary program does not already have an internship component, a co-op arrangement with local employers could be added. The student could be placed into a supervised work-based learning position for one or two quarters or a semester in order to gain practical experience or apply skills learned.

Establishing a duration for TPAD relates directly to the expectation of skills to be possessed by the student graduating from the program, whether at the high school or postsecondary levels. Once determined, this should dictate the program duration and structure.

Student Ability Levels

One factor which affects both the duration and the structure of a TPAD program is the ability levels of students involved in the program. This can be a very difficult issue. In some instances, demonstrated ability levels have a lot to do with expectations. In others, they have to do with mental capabilities, learning deficiencies, and/or learning styles. However, if the education system begins with the belief that all youth can learn, then educators begin to deal with specific challenges and difficulties.

Addressing the issue of ability levels, of course, requires using some form of effective student-assessment system. The assessment system needs to start very early in the child's school career, possibly even at the preschool level. The question of which system to use is beyond the scope of this chapter. Regardless of which system is chosen, however, the question remains: "Should the TPAD program be designed to accommodate varying ability levels?"

The answer to this question will be largely determined by the overall philosophy of the local school system. It will also depend to a certain extent on the final competencies required. For the high-school TPAD program to prepare the student adequately for the next educational step—the technical associate-degree program—and for the postsecondary program to prepare students for the marketplace, it is certainly necessary to establish and maintain standards of necessary accomplishment.

However, this must not be interpreted to mean all students must achieve these necessary accomplishments within a single time frame. In the Richmond County TPAD program, it was necessary in some cases to establish "A" and "B" levels for certain courses in order to allow for different ability levels. One such course, Algebra I, had to be established as Algebra IA and Algebra IB. Each level represents a full year of instruction. Therefore, students who could not accomplish the Algebra I course in a single year were given two years to do so. Through this process, the quality of Algebra I was not compromised.

A similar process could be used for a variety of courses to help students of differing abilities reach their educational and career goals. Logically, through this approach, a student may not complete the entire tech-prep program within the normal time span of a four-year high school program plus two years postsecondary. In North Carolina, students also have the option of taking a one-year technical specialty at the community-college institution. This may be a more realistic goal for some students than a two-year technical associate-degree program.

If the purpose of the local school system is to have a TPAD program that increases the academic and technical competence of all students and to motivate students to strive toward such expectations, then the system will adopt methodological practices that address the varying ability levels among students. After all, even if some students do not eventually achieve the full benefits from the prescribed TPAD curriculum, the competencies they do acquire will put them in better stead for life than would a less-demanding program in the general curriculum.

Curriculum

As indicated in earlier chapters, determining what should be taught in TPAD programs is a significant issue. This will normally be done by reviewing at least three components—state and/or local graduation requirements, entrance requirements for the technical associate-degree program, and the knowledge and skills required by business and industry at the various stages of the educational process. Typically, the latter component is given the least consideration. This is unfortunate because the employer-educator partnership enhances the success of the total TPAD effort significantly.

Another way to approach the curriculum question for high schools is to work backward—to review the postsecondary technical curriculum and determine the minimum level of academic and applied skills which must be possessed by a freshman entering an associate-degree program. Once these are documented, the high-school courses and competencies which will provide these needs can be easily identified.

Either of these approaches will probably recognize that a strong program of applied academics is needed. In most instances, research will also show that this academic base is enhanced by a strong technology curriculum. This leads to the question of articulation—determining how to implement the necessary curriculum with smoothest transition and the least amount of overlap or duplication.

To be most effective, this activity requires the interaction, either one-on-one or in small groups, of the secondary and postsecondary faculties. If done correctly, this will be the most time-consuming task in the process of establishing a TPAD program. Articulating curricula could take up to six months or more, depending on what kind of relationships and interaction have existed between the two institutional levels in the past. Coming to consensus may require accommodations to be made by both parties, but will probably ask more of the secondary schools. This can be especially true if academic courses need to have a stronger application base and vocational/technical courses need to include stronger academic competencies. If the secondary educators involved are unwilling to do so, then the program will not be as strong as it should be.

Some of the curriculum modifications or alignments secondary schools may be required to make are inclusion of advanced academic courses not currently available, addition of more meaningful applications to existing academic courses, and quality (in some cases, extensive) upgrading of vocational and technology courses. In support of these efforts, the postsecondary institution may agree to modify or align its curriculum areas to de-emphasize teaching of skills that students will now acquire in high school or to include more accelerated skills into their course areas.

This approach not only ensures a smooth articulation process, but also resolves all concerns by the two educational levels as to where subject areas begin, how they proceed through the high-school years, and how they are built upon at the postsecondary level.

As already indicated, curriculum modification, alignment, and articulation require extensive, concentrated time. Often the personnel involved must work *competency by competency* through various courses of study. Once the evaluation has been completed, the modifications required may well mean a total rewrite of the course curricula—again requiring concentrated time. This is not something that one does after normal school hours. It should be handled through granting release time to staff members or by employing teaching personnel during the summer months. In all cases, to qualify for the TPAD program, courses must be at grade level or above.

Staff Development

The importance of staff development has been touched upon in chapter 4 and in previous parts of this chapter. As with any endeavor, it is important that individuals involved with TPAD be adequately prepared. Staff development for both secondary and postsecondary personnel is a vital component in the planning, implementation, maintenance, and expansion of TPAD programs. Staff development is equally important to the business community as it becomes involved. In many locales, community-based staff development for employers will be a new concept. This is more than just a public-awareness thrust. Such staff-development programs actually focus on training business and industry personnel in ways they can contribute to the design and implementation of the TPAD program.

The importance of preparing staff members to accept each respective area of development in the TPAD program cannot be minimized. In fact, staff development will be one of the three most important segments in the process (the other two being promoting ownership by the people involved and articulating the curriculum). The effective implementation of the TPAD program will ride on the preparation of people involved. TPAD is a human-resource-driven program. All the technology and financial resources in the world will not make it a success unless the people can deliver. It is critical, therefore, not to move forward with the TPAD program until the people involved are prepared to do so.

Staff development will generally occur through a variety of activities. In designing the overall development of a TPAD program, it is important to develop an organized, step-by-step staff-development strategy that includes proposed timelines for each activity.

The staff-development strategy may be developed in several ways. The most logical one is to review all the steps and timelines which have been proposed for the design, implementation, maintenance, and expansion of the TPAD program and to ask concerning each: "Is this an area or activity for which the staff (or other people) need to be inserviced (developed) prior to undertaking the responsibility?" Answers to this question will encompass several of the issues referenced in this chapter, as well as issues raised elsewhere in this book. Some possible subjects for staff development are:

- understanding the TPAD concept and the need for TPAD,
- knowing the secondary-system and postsecondary-system goals,
- comprehending the roles of the various communities,
- developing effective TPAD agreements,
- articulating curricula,
- dealing with student ability levels,
- working effectively in teams,
- developing meaningful evaluation instruments,
- marketing TPAD effectively, and
- handling stress generated by the changes that TPAD requires.

The above list is by no means exhaustive. Most of the staff-development activities will be determined by what the people involved already know and what they need to know.

In general, secondary- and postsecondary-school staffs will conduct the activities. However, this is also an excellent opportunity for locales to utilize appropriate university-based personnel, employer representatives, and state education department staff members.

Evaluation

The success of any program depends on the ability to document higher levels of student accomplishment and to make both quantitative and qualitative evaluation of program improvements. This is not always an easy task. Very clear and precise goals and objectives are required. Development of an effective evaluation program will therefore require considerable time—at least several months—on the part of the staffs of the two educational levels. Fortunately, there are many models available which can be adopted or adapted.

Determining *when* the evaluation process (and/or instruments) is developed is also important. Typically, the procedure is to first design the TPAD program and then set up a process to measure its accomplishments. This is probably the most appropriate process, but it is also possible to develop the evaluation process first and design the program to fit the evaluation method. Program design and evaluation are almost a chicken-and-egg situation; they depend on one another and need to be developed almost simultaneously.

A program such as TPAD involves many intangibles which cannot be measured immediately or over a short duration. It is necessary, therefore, to determine how important short-term evaluation is and how it can be combined with evaluation over a much longer period of time. Some other questions might be:

1. *Who will measure the effectiveness of the program and how?* Will evaluation be carried out by the public schools, postsecondary institutions, employers, and/or others? All of these will likely be involved to one degree or another. Therefore, it is very important to have adequate representation in answering this question. (See chapter 4 for information on putting together an effective Evaluation Committee.)

2. *What will the measures of effectiveness be?* Will evaluation be based upon the goals and objectives of the program only, or will other criteria be included? Will evaluation restrict itself to the students who complete the program, or will it measure the competencies gained by all students who participate? It is important to know these things up front. Can all of the desired criteria be evaluated? How important are the criteria identified to student success?

3. *Who determines course credit to be received by the student at the high-school level? At the postsecondary level?* Logically, each of these levels would determine its own credit. However, high-school credit should not be determined without the involvement of the postsecondary institution which will receive graduates for further study. Likewise, if high-school students are to take courses for high-school (or college) credit at the postsecondary institution, then the high school needs to agree that the course duration and curriculum meets its standards. This question can usually be resolved through the effective handling of the curriculum-modification and articulation process.

4. *What determines satisfactory completion of a course or the entire program?* The curriculum-modification and articulation process is also critical to answering this question. Agreement between the two educational levels on this point will ensure that any student who meets the identified standards for the TPAD high-school program will be considered to have satisfactorily completed the program and will be eligible for the postsecondary component of the program. The same would be true for the associate-degree program, or for any specific course. Some of this decision could be based on the answers to question 5, below.

5. *What role does testing play in the evaluation process?* Will competency be measured by written tests, or will it be entirely performance-based? Will testing be used on selected courses, or at all? How much testing is appropriate, and when should it be used?

Successful TPAD programs in North Carolina have answered these questions as well as others. Based upon satisfactory mutual working arrangements between the institutions involved, existing testing and evaluation standards, and other criteria, the evaluations systems that have been developed are now being used successfully to document student performance and the overall effectiveness of the program.

OPERATIONAL ISSUES

Agreements

A written agreement (Executive Articulation Agreement) between the local school-system board of education and the postsecondary board of trustees (or education) should be developed as early in the development stages of a TPAD program as possible. Such an agreement will solidify the strong commitment of both boards. Other types of agreement are the Administrative Articulation Agreement describing course articulation and the Course-of-Study Agreement between the high school, the student, and his/her parent(s).

1. *Executive Articulation Agreement and Administrative Articulation Agreement.* The initial agreement between the two education boards (EAA) does not have to be a massive one. However, it is important that it identify succinctly what each proposes to do and what each expects from its involvement in a TPAD program. The specifics of the agreement will be different for each locale. Some of its components might be:

- purpose of the agreement;
- definition of an accepted TPAD program;
- need for the TPAD program;
- conditions for the TPAD program; and
- state and/or local policies applicable to the TPAD program, such as those determining student and course eligibility, an exceptions procedure, general policies, and program administration.

The second agreement between the two schools (Administrative Articulation Agreement) will be signed at the conclusion of the curriculum-articulation process. It should cover such articulation issues as:

- course equivalency,
- advanced placement,
- college and high-school credit, and
- competency verification.

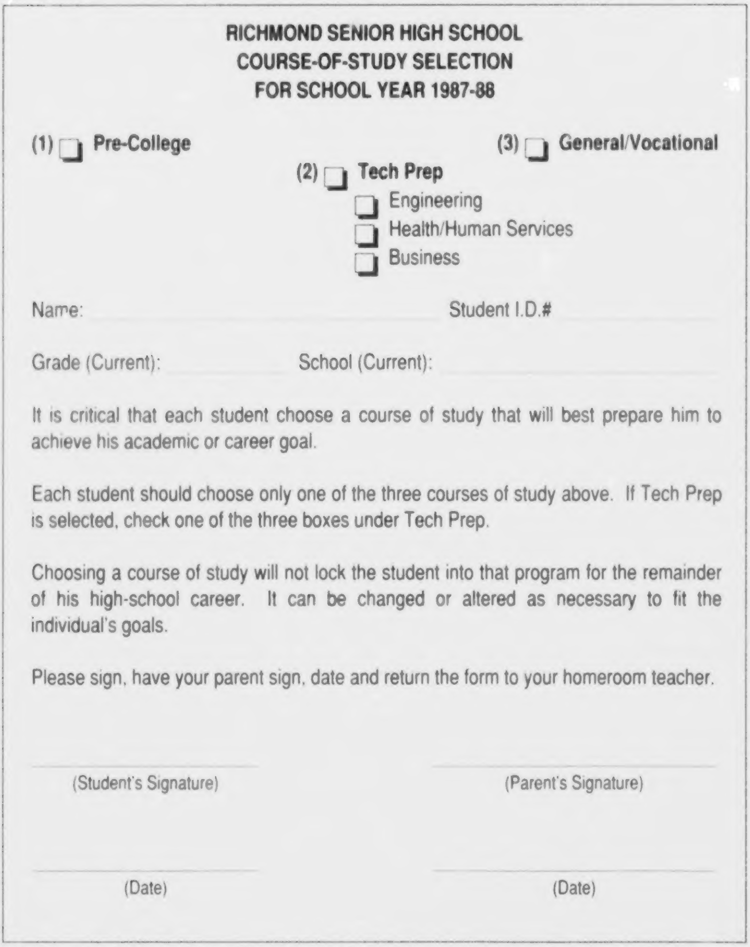
If enough attention has been given during the curriculum-development phase to resolving these issues and promoting understanding, this agreement will be relatively easy to put together.

Neither agreement between secondary and postsecondary boards needs to be a legally binding contract; they can be simple statements of understanding between the two boards. Such an agreement of understanding has worked most effectively in North Carolina.

It is important that the agreement be reviewed at least annually and revised as necessary. As implementation of the TPAD program proceeds, various points may need to be added to or deleted from the agreement. It is important to think of the agreement as a "living" document which can be adjusted to ensure that the program is responsive to student needs and flexible, yet based on standards that guarantee the quality of the TPAD program.

2. *Course-of-Study Agreement.* The primary purpose of this agreement between the local school system, the student, and his/her parent(s) is to ensure that all parties understand and have a commitment to the course of study being selected by the student. However, it is also an excellent counseling tool. Many school systems across the country are using such a device for guiding students into the selection of a course of study. The Course-of-Study Agreement helps the student solidify his/her commitment and spells out ahead of time the requirements for completing a successful and rigorous course of study. This has long been considered necessary for college-prep students; now all students can benefit from the same type of attention.

An example of such an agreement, used by Richmond Senior High School, Richmond County Schools, appears in figure 1.



RICHMOND SENIOR HIGH SCHOOL
COURSE-OF-STUDY SELECTION
FOR SCHOOL YEAR 1987-88

(1) ☐ Pre-College

(2) ☐ Tech Prep
  - ☐ Engineering
  - ☐ Health/Human Services
  - ☐ Business

(3) ☐ General/Vocational

Name: ____________ Student I.D.# ____________

Grade (Current): ____________ School (Current): ____________

It is critical that each student choose a course of study that will best prepare him to achieve his academic or career goal.

Each student should choose only one of the three courses of study above. If Tech Prep is selected, check one of the three boxes under Tech Prep.

Choosing a course of study will not lock the student into that program for the remainder of his high-school career. It can be changed or altered as necessary to fit the individual's goals.

Please sign, have your parent sign, date and return the form to your homeroom teacher.

(Student's Signature)

(Parent's Signature)

(Date)

(Date)

Figure 1: Richmond Senior High Course-of-Study Agreement

Faculty Needs

TPAD developers who begin assessing their capabilities to implement the curriculum may make some interesting discoveries regarding the preparedness level of existing faculty. One discovery may be the need for technology equipment and help in how to use it. Another may be that many faculty members do not possess the knowledge for competencies that must be taught in a TPAD program. Still another may be the need for additional faculty at either level. Many other faculty needs may emerge as well.

As highlighted earlier in this chapter, the development of a TPAD program is definitely a restructuring process. Academic teachers will be called upon to strengthen their curriculum offerings and to increase application practices in their classes. In many instances, this will require making technological equipment available at the high-school level for the first time. Some academic staff members will be uncomfortable with these changes.

Likewise, faculty members may be very qualified to teach some courses in the curricula, but not necessarily all of those which may be required. For example, certain high-school teachers may be excellent in basic academics but not qualified in advanced areas such as physics or calculus. Vocational and technical faculty members may have difficulties infusing applied or traditional academics into their courses.

To appropriately empower teachers for implementing TPAD, schools must provide effective staff development. Simply telling teachers to incorporate applied academics or placing them into a classroom with new equipment does not mean that applications will be taught effectively or the equipment will be used. Training is necessary, and this training is not a one-shot deal. It must be continuous until the faculty member feels comfortable with the new emphasis and teaching tools.

In some instances, of course, the staff development required may simply be too extensive to undertake. An alternative would be to have certain courses taught at the postsecondary level or to bring in personnel from business and industry and/or the university system to teach selected subject areas, either in part or in whole. An example of "in part" would be where a faculty member has a good grasp of the overall subject area but needs assistance in teaching specific applications.

Secondary and postsecondary institutions might well discover that there are simply not enough faculty members available to offer the courses required for the TPAD program. Unless other alternatives, such as distance learning through telecommunications, are available, funds must be found to add the positions needed.

It is very important to survey staff at a very early date to determine what the needs are in this area. These needs must be addressed prior to implementing the TPAD program if the program is to succeed. A program will fail, for example, if faculty are expected to teach concepts and theories without the necessary equipment and materials for students to apply those concepts and theories. Some needs can be satisfied through the use of local employer resources or cooperative education techniques.

Facility Needs

In North Carolina, with approximately four hundred fifty high schools and fifty-eight community-college institutions, the availability of facilities to offer TPAD programs has not been a problem. This may not be true in other locales. Even if facilities are available, the structure and capabilities of those facilities should be studied carefully. It is very important, for example, to be sure that science laboratories are adequate to provide the applied-academics experiences that students need. The same is true for other academic and vocational/technical classrooms, laboratories, and shops. Renovations may be required, and facilities may even need to be added, so it will be important to plan for this and to request funds appropriately.

Depending upon the courses to be offered, safety factors may need to be a consideration. This is especially true in the sciences and certain vocational/technical laboratories and shops. Equipment must be well-maintained to avoid accidents. Hazardous chemicals must be properly handled, stored, and disposed when they are no longer useful.

A safe, adequate, and appropriately equipped facility is vital to the success of a TPAD program, but this area of planning is too often overlooked. There is a tendency not to provide adequate attention to the appropriateness of facilities. Failure to plan for appropriate facilities and equipment to support the instructional program will inhibit quality instruction.

If the local school system and/or the postsecondary institution are unable to generate the funds necessary to provide the needed facilities, alternatives are available. In North Carolina, facility and equipment problems have been addressed through cooperative education or other on-the-job approaches, such as using the facilities and equipment of local employers for classes or leasing facilities from business and shopping centers.

In Lincolnton, North Carolina, for instance, a nationally operated company donated to the local school system a one-million-dollar facility and approximately four hundred thousand dollars in funds for equipment to establish the Lincoln County School of Technology.

Other businesses in the community donated funds for equipment. This center is highly focused on technology, provides instruction to students from three local high schools, and links the public schools and the local community college. The local industry development staff also has offices in this center, thereby creating a very workable triad.

Marketing TPAD

Marketing the TPAD program is an extremely important issue. "Selling" TPAD is no different from promoting a new product or service—and it's just as necessary. The initial success of the TPAD program will depend almost as much on developing an effective marketing program as it will on having a relevant, rigorous instructional program. This aspect of the program will require *marketing expertise*, *time*, and *money*.

Marketing cannot be a one-time activity or a hit-or-miss one. It is an educational process in its own right. For this reason, the marketing plan for TPAD needs to be drawn as carefully as the planning for the TPAD program itself. It must contain provisions for addressing both internal (within the education systems) and external (all those outside the education systems) audiences.

An effective marketing program really begins with a strong, active, and involved advisory committee. Ideally, this committee consists at least in part of advertising and marketing professionals. Once they grasp the TPAD concept and understand the program, these people begin to look for avenues to communicate with the school staffs, parents and students, employers, and the general public.

The first audience for TPAD marketing strategies is internal—the secondary and postsecondary boards and staffs. It is critical that these people understand the TPAD program and accept ownership. However, this is only the initial step. Parents must understand the benefits of the program so they will encourage their youth to participate. Students must understand TPAD and be motivated to take the more rigorous curriculum. Employers must be encouraged to provide the kind of support needed by the school and the students. Local boards of education and trustees, county commissioners, and the general public must be willing to provide the dollars needed to support the program.

The most outstanding example of an effective TPAD marketing program in North Carolina has been in Richmond County. Richmond County Schools and Richmond Community College made use of a variety of marketing techniques, including:

- full- and half-page advertisements in local newspapers announcing the TPAD program and explaining its purpose;
- frequent news articles in the local papers reporting on the progress of this new concept;
- solicitation of local businesses and industries to put announcements and descriptions about TPAD in their employee publications and to hold in-plant meetings for employees to discuss TPAD;
- presentations to civic organizations;
- public-service announcements and interviews on local radio shows (areas with local television stations could do the same with TV);
- brochures and flyers included by local utility companies with their billings;
- posters displayed in a variety of local businesses, industries, and shopping malls;
- Parent Teacher Association meetings;
- school open houses;
- assembly programs for students; and
- local billboards.

This list is far from exhaustive. Many additional techniques have been used. One of the most effective was a TPAD packet of materials which included a very modern and colorful brochure describing the various curriculum options available to students. The attractive and colorful materials created a very positive image for TPAD.

As in any effective marketing program, timing and consistency are important. One of the reasons Richmond County was so successful is that those responsible for marketing kept the TPAD program constantly before the public. Students became very excited about this opportunity and responded. Other TPAD programs in North Carolina have capitalized on the marketing techniques used by Richmond County.

While there will be many inexpensive ways for accomplishing the strategies within the plan, some funds must be earmarked for marketing efforts. The North Carolina systems were able to accomplish this through a combination of public and private-sector funds.

The marketing plan needs to be developed in the early stages of TPAD planning. Appropriate strategies must be reinforced by very specific timelines for accomplishment. Media resources must be identified. Print, audiovisual, and speech materials need to be outlined and storyboards developed. Release of publicity should be strategically timed to keep new information or teasers before the public on a consistent basis.

Most important, the marketing program must not stop once the TPAD program starts. Developing the marketing plan must be an annual activity and spreading the word about TPAD an ongoing concern.

Accreditation

Accreditation of the TPAD program was not an issue in North Carolina, but it may be in other states. Obviously, TPAD developers should keep in mind any accreditation criteria, required by state, regional, and/or national accreditation systems, that might apply to local public schools and postsecondary institutions.

Even where accreditation is not an issue, it is very important for the TPAD program to encompass in both form and substance the expectations of parents and local employers. Accomplishing this requires active involvement of these groups in the program design and implementation.

The accreditation systems subscribed to by local school systems and postsecondary institutions normally focus on process and, to some extent, product. Many are built upon the resources available to a school or institution—the number of facilities, amount of equipment, number of library books, and so forth—rather than on achievement outcomes. If accreditation from such a system is sought, then the schools may need considerable new resources before they can begin a TPAD program.

In each circumstance, the local school system and postsecondary institution will need to decide whether to seek accreditation and, if so, what kind of accreditation they wish to seek. The award of an accredited associate degree for TPAD-program completers will probably lend additional status to the program and serve as an incentive for students to complete the entire course of study. If these elements are needed or desired, then accreditation should be pursued. Accreditation standards and the satisfying of those standards may also help ensure the continuation of a high-quality program. Since the postsecondary institution has primary responsibility for compliance to standards for the associate degree, the secondary faculty and administrators will need to be sensitive and accommodating to what may seem arbitrary requirements in course content, course delivery, and faculty credentials.

A potential risk of participating in an accreditation system is the danger of the TPAD program becoming inflexible. Accreditation systems that are outcome-based—that is, focused on achievement rather than resources—usually allow a TPAD program a better chance for maintaining flexibility in meeting the needs of students.

RESOURCE ISSUES

Local school systems and postsecondary institutions will face one mammoth issue in planning for and implementing a TPAD program—money. Will there be funds to effect the change needed? Where will the funds come from to pay for this new program? Those proposing a TPAD program will hear comments such as, "All of our funds are presently committed. There is nothing we can give up in order to start this new program. It would be nice, but we just cannot see any way." Sound familiar?

The old cliché, "Where there is a will, there is a way" must represent the attitude local school systems and postsecondary institutions take when they begin with TPAD. And the good news is: there *is* a way. Through either redirection of existing resources or acquisition of new funds, the necessary money for getting TPAD underway can usually be found. In summary, if there is truly a commitment to TPAD "from the top," adequate funding will be made available.

Redirection of Resources

Redirecting resources is important because most school systems that implement the TPAD program will not be able to count on a major infusion of new funds. Most systems must depend primarily on existing financial resources. This has been true in North Carolina. Fortunately, if a system plans appropriately, major outside funding is not needed. (This assumes, of course, that the system has *some* resources and is not starting from zero!) A thorough analysis of the possibilities for resource redirection must occur within the early stages of the TPAD program.

One advantage of implementing TPAD as far as possible with existing resources is that such a program becomes institutionalized immediately. Using large outside sums for a project puts that program in danger of withering when the external funds dry up. This does not mean that additional resources are not needed, but they should be for one-time expenses such as planning and equipment rather than ongoing operational expenses. How and where to obtain such funds will be discussed in the next section.

Once the overall design of the TPAD program has been completed, the local school system and the postsecondary system should do a systematic review of what components in the design are already available or could be made available with nondescriptive types of modifications.

For example, most of the necessary staff should already be in place, including counseling personnel. Many of the facilities should be available at either the high schools or postsecondary institutions. A substantial amount of the supplies, materials, and equipment (academic, vocational, and technical) should be in place as well. Since the program will be offered during the hours that the high schools and postsecondary institutions are already operating, there should be no major increase in utilities or other operating costs.

One new expense for which most school systems will seek funding is the salary and support costs for a person to coordinate the TPAD program planning and implementation. My personal position, based on experiences in North Carolina, is to discourage this. The matter is open for debate, however, and cogent arguments exist for either side.

When one person is hired to coordinate the program, then TPAD, in the minds of all involved, tends to become that person's program and responsibility. In my opinion, it is more effective (and less costly) to identify the responsibility for coordinating TPAD with an appropriate position already in the system. After all, TPAD is just another education option. And there are few cases, if any, where a person in a local school system has as his/her specific responsibility, say, the college-preparatory option. Levels of responsibility for the TPAD option can be assigned to different individuals within the school system—for example, the associate superintendent, assistant superintendent, director of academic instruction, director of vocational and technical instruction, and/or the high-school principal.

One method for redirecting resources may be to focus the available dollars differently. Some school systems use a process of dividing funds equally among all of their programs or subject areas. In many instances, this creates a situation in which no one program receives enough funds for any kind of significant impact.

A more appropriate approach, especially with limited resources, is to design an impact plan. This plan identifies the needs of programs in critical or priority order, then focuses existing funds on first-priority programs in amounts sufficient to achieve standards. This means, of course, that lower-priority programs will have to wait for funds, but it also ensures that the programs that are funded will be able to begin at the established standards. Ultimately, it is hoped, all programs will be able to achieve their standards. The addition of new resources, of course, will speed this process.

Once the issue of redirecting financial resources is resolved, consideration should be given to redirecting the human resources available. The school system will discover that there are program (or course) areas which need to be eliminated, added, refocused, or strengthened through modifications such as increased competencies or applied practices. While this could mean the discharging or reassignment of some staff members, retraining the existing staff is a more positive and economical approach.

The question of retraining certain staff is never an easy one. Depending on the existing skills of the individuals and the magnitude of the retraining needed, time may not permit this to occur. In those circumstances, the local school system may have no choice but to replace certain staff member(s). These decisions will depend heavily upon the amount of time the local school system allows between design start-up and partial or full implementation of instruction. The more time between these two steps, the more opportunity the school system will have to assist a staff member in making the transition, by either developing the necessary skills or finding other employment.

In considering the use of human resources—especially if staff additions need to be made—the local school system and postsecondary institutions need to determine the most appropriate locations for programs, courses, or staff. Let's assume, for example, that there is a course which should be available at both the high school and postsecondary levels, but enrollment is insufficient to support a full-time staff member at each level. The decision might be made to locate the staff member at the postsecondary institution and to let the high-school students attend class there. Another option would be to create an itinerant arrangement in which the staff member teaches part of the day at the high school and the rest of the day at the postsecondary institution.

If small school systems are to participate with a postsecondary institution in a TPAD program, the need for creativity in staff positioning is increased. Instructional innovations such as distance learning or electronic linking between the two institutional levels can be especially helpful in such situations. North Carolina has used interactive telecommunications successfully in a few areas of the state.

When making the type of decisions described above, it is critical that funding patterns and procedures not dictate program direction. Unfortunately, this is not always the case. If funding does control program development, local school systems may be forced to think too narrowly. Problems that do arise should be resolved at the policy level.

New Resources

Although much can be done with existing resources, a beginning TPAD program will almost certainly need some additional resources. Once decisions have been made on the redirection of existing resources, therefore, a statement needs to be developed on what more is needed. (This assumes, of course, that a total budget has been developed as a part of the TPAD program design.)

Typically, the traditional line items found within a budget will show increased needs. Some of these are personnel, capital outlay, and operating expenses. Depending upon the accounting system used, needs in the capital-outlay line item will be facility additions and/or modifications and equipment. In the operating-expense category, some new needs will be contracted services (such as itinerant teachers, telecommunications, transportation) and program marketing.

The program marketing line item may be the one which raises the most questions, as this is not a usual expenditure for public schools. (It is more common in a postsecondary budget.) However, this is a critical need for a TPAD program; every effort should be made to secure funds for it. As is true of any budget request, the local school system needs a very strong statement to support this request. Such a statement should include an explanation of TPAD statistical data and positive experiences in communities where TPAD programs have implemented an aggressive marketing strategy.

In North Carolina's experience, a single local school system and a single postsecondary institution partnership requires a minimum of twenty-five thousand dollars for planning a TPAD program. (This amount does not include new staff salaries.) These funds are needed to provide staff development for both education levels, release time, substitute pay or stipends for teachers and instructors from each level who develop or articulate curricula, appropriate materials and supplies needed for staff development and curriculum-articulation activities, initial marketing efforts, travel, and specific types of purchased services required.

Depending upon the size and scope of the program in the two local education levels, it has been determined that an average of one hundred thousand dollars is needed annually to bring program areas in high schools to standard and maintain that standard. This determination was driven strongly by technology equipment needs.

A budget request for new resources should indicate the anticipated source of these resources—and strong justification must be based upon hard data. North Carolina has done this by developing an equipment-standards handbook for all the vocational and technical courses taught at the high-school level. Each local school system in 1986 evaluated its existing vocational equipment for each course according to these standards. The result was that, statewide, local school systems needed $101 million to bring all courses up to standard.

This survey has served as the documentation for annual equipment requests to the state legislature. Likewise, school systems use their local survey results to support funding requests to their local boards of education and county commissioners. In some isolated cases, local business and industry have provided the needed technology equipment. Other school systems have offset these needs through the increase of cooperative-education programs or other on-the-job approaches and through sharing arrangements with postsecondary institutions.

THE KEY TO SMOOTHING THE ROUGH SPOTS

No program develops without difficulties, and TPAD programs are no exception. People problems, policy challenges, and funding dilemmas will all place obstacles in the path of successful development. Nevertheless, as North Carolina's experience shows, TPAD programs work. Issues can be resolved and obstacles overcome. And the reward for the work involved in overcoming the difficulties is a strong, smoothly functioning system that fulfills the expectations of all involved.

It is important to keep in mind that implementing a TPAD program—including resolving issues and overcoming obstacles—is an ongoing effort; it will not be accomplished in a day or even a year. As June Atkinson of the North Carolina Department of Public Instruction reminds us, the development of TPAD is not an event; it's an ongoing process. Fortunately, it's a process that moves each of us ever closer to making education a win-win experience.

6

SUCCESS STORIES

Examples of Working TPAD Programs

Opening the Doors to a Brighter Future in North Carolina •
Preparing Health Workers In North Texas •
2+2+2 Equals College Credit in California •
Setting the PACE in South Carolina •
A TPAD Summer Program In New Mexico •

"In their diversity of environments and purposes, these programs demonstrate:

- *successful planning and issues resolution,*
- *increased emphasis on academics in the curricula,*
- *program clustering in technical areas,*
- *broad participation and commitment,*
- *elimination of the general-education track, and*
- *remarkable improvement in student interest and achievement."*

Introduction

Most of the information presented in earlier chapters focuses on what the editors of this book consider to be the ideal model of TPAD programs. In reality, however, TPAD is an evolving program, still in its early stages. Although a number of successful TPAD programs exist, none to date has implemented this proposed TPAD model fully.

For instance, this book proposes a full advanced-skills curriculum, but fewer than 10 percent of the many 2+2 (or 4+2) articulation programs currently in operation provide this. While significant course changes are occurring at the high-school level and students are entering (articulating) into postsecondary technical programs with greater academic abilities, few postsecondary schools have added advanced-skills enhancements for these students. While it is not surprising that advanced-skills TPAD programs have been slow to emerge, it will indeed be disappointing and unfortunate if more TPAD programs fail to reach this stage of maturity in the near future.

Despite the variations from the proposed model, however, TPAD programs are flourishing around the country. This chapter tells the stories of five such programs—good early examples of Tech Prep/Associate Degree. Each program was created in a different way, for different reasons, and under different circumstances. They vary in the articulation model they follow, ranging from a 3-month summer tech-prep program to a full 2+2+2 model. Some do not use all of the applied-academics courses that were described in chapter 3; most of these programs were created before the applied-academics course materials were even available.

Despite these programs' diversity—or perhaps because of it—they are all important to study, examine, and compare because they show how TPAD can be adapted to local needs. In their diversity of environments and purposes, these programs demonstrate:

- successful planning and issues resolution,
- increased emphasis on academics in the curricula,
- program clustering in technical areas,
- broad participation and commitment,
- elimination of the general-education track, and
- remarkable improvement in student interest and achievement.

In editing these valuable contributions, we have taken the prerogative of substituting the term *TPAD* to describe the secondary/postsecondary articulated program, even though the term was not yet in use when these programs were developed. We have reserved the term *tech prep,* often used for the entire program, to refer only to the high-school or precollege element of the TPAD curriculum. Other than these minor adjustments, we have let the participants in these programs tell their own stories.

Opening the Doors to a Brighter Future in North Carolina

Doug James

Richmond County lies on the green coastal plain of North Carolina—a little more than a hundred miles inland and directly adjoining South Carolina. As in many parts of the Southeast, the economy of Richmond County is heavily driven by textile and associated industries and business enterprises. And the textile industry in turn has been heavily influenced by two major changes:

- a shifting balance of international trade and intensified economic competition between countries, states, and regions and;
- a transition from labor-intensive industry to high-technology, advanced communications, service occupations, and small business.

The dual impact of these two major changes, which were being felt acutely in Richmond County by 1985, led to a serious reassessment of what Richmond County schools were doing to prepare students for a changed world. The result of that reassessment was Richmond a county's ground-breaking and highly successful TPAD program.

There has always been a close connection between the educational level of the citizens of a community and that community's economic growth and development. Now, with more technological and computerized processes emerging, the need for a higher level of education of all citizens to develop and sustain our economic base is significantly greater.

This does not mean, however, that all students need a traditional baccalaureate degree. Studies have shown that, although business enterprises and service occupations continue to expand, the job market in Richmond County does not currently demand a high percentage of four-year college graduates. Many young people who graduate from four-year colleges never return to Richmond County for employment. Thus, a large portion of the economy is driven by high-school graduates with some technical training beyond high school.

The transition of our industries and service occupations from the more traditional processes to computerized technological ones will still not require many more four-year college graduates. However, it will demand significantly more employees who have better communications, analytical, and technical skills. Local employers continue to upgrade their educational requirements for entry-level jobs. They are no longer looking for an assembly-line worker who will perform basically the same task for the next twenty years. Instead, they want employees who are trainable, who are problem solvers, and who are promotable within the context of their technological advancements.

A 1985 study of the Richmond County economy made by MDC, Inc., a Chapel Hill research firm, made this clear:

> If Richmond County is to prosper 10, 20, and 30 years into the future, its work force will have to be far better trained and educated than it is today. In addition to assuring that students graduate, public schools must work to improve school-to-work transition programs. Too often students leave high school with a diploma, but without a job or any plan to continue their education in college or vocational training. Students must be encouraged to plan ahead. A new ethic that education is a 14-year process must be instilled and increased linkage should be established between public schools and community and technical colleges.

With the establishment of TPAD, that "new ethic" has been built in to the basic process of secondary education in Richmond County.

RICHMOND COUNTY BEFORE TPAD

In June 1986, an analysis of graduate intentions of Richmond County seniors revealed a general lack of purpose and direction among large numbers of students. Out of the entire graduating class, 24 percent planned to attend four-year colleges; 27 percent planned to attend community, trade, or technical schools; and 12 percent would go into the military. The remaining 37 percent planned to go directly into the work force or get married, or had no plans at all (figure 1 shows the dramatic changes in those numbers since implementation of a TPAD program).

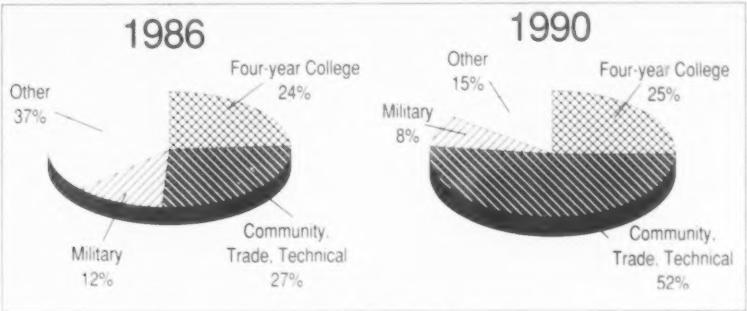


Figure 1: Graduate Intentions in Richmond County

The high-school curriculum at that time included the traditional precollege courses, a general academic course of study, a basic academic option, and a vocational education program. While a concerted effort was made to ensure that students who planned to go to four-year colleges enrolled in the appropriate college preparatory courses, other students—about 75 percent—chose one of three other courses of study with little direction other than getting enough courses to graduate. This meant that many students were enrolling in high-school courses indiscriminately, without a specific academic or career goal in mind. And many graduates were enrolling in trade or technical schools with inadequate backgrounds in math, science, communications, basic principles of technology, or business.

Richmond County's TPAD program was designed for this "neglected majority" who may not pursue four-year college degrees but will increasingly require postsecondary education and perhaps later retraining to remain competitive in Richmond's (and the country's) job market. It is a four-plus-two program with strong academic requirements and upgraded, contemporary vocational/technical courses.

For an economy that is rapidly changing from traditional manufacturing to computerized technological processes, entrepreneurship, and service occupations, we think a heavy concentration on job-specific skills at the high-school level is ill advised. A heavier concentration on helping students develop better communication and mathematical skills, a better understanding of applicable scientific concepts, and a basic understanding of technological principles, coupled with appropriate hands-on experience, will better equip those students to survive in a rapidly changing job market.

TPAD PLANNING IN RICHMOND COUNTY

In 1985, a comprehensive study of Richmond County schools, culminated in the establishment of "Six Education Goals for Economic Growth" to be achieved by 1990. On the basis of that study and MDC, Inc.'s study of Richmond County's economy, the superintendent of schools and the president of Richmond Community College began an extensive dialogue on how the institutions could work more cooperatively and effectively to prepare Richmond County youth for the rapidly changing job market. This dialogue was later expanded to include the public schools' director of vocational education, the principal of Richmond County Senior High School, and the college's deans of instruction and student services on a steering committee. The Richmond County Vocational Advisory Council and the education committee of the Greater Richmond County Chamber of Commerce were significantly involved from time to time.

Dale Parnell's book, *The Neglected Majority*, encouraged the steering committee to give serious consideration to the TPAD concept. Studies of rapid developments in communications, science, and technology, as well as emerging job-market trends on the local, state, and national levels seemed to justify this consideration. Most labor-market projections indicated that 75 percent of all new jobs through the year 2000 would require technical education beyond high school, while simultaneously the number of jobs requiring only a high school education would rapidly decline. All research data pointed to a heavy need for programs in:

- engineering technology (electrical, industrial, mechanical),
- business/entrepreneurship, and
- health/human services.

These were chosen as initial career clusters for the new program.

Serious attention was given to the 2+2 system of articulation, but a 4+2 program was eventually selected. It was felt that 4+2 would help motivate high school students to focus on academic and career options earlier to enhance mastery of needed communications, math, science and problem-solving skills.

Because Richmond Senior High School is a large comprehensive high school, it would have no difficulty providing all the appropriate tech-prep courses. None, therefore, would have to be provided by the college. However, the course-of-study sequence from grade nine through completion of the associate degree had to be carefully mapped out by staff and communicated to students. Skills and competencies of associate-degree completers had to reflect local and regional job-market trends as well as state and national ones.

Most community business and industrial leaders were highly supportive of the TPAD concept from the beginning. However, the superintendent of schools and the community-college president realized that the development and implementation of a TPAD program would require the support of the entire community in order to succeed. Significant changes in the educational perspective would be required of the staff of both institutions, and their strong commitment was a must, as were the continued involvement and support of parents, students, and community organizations. Thus, steering committee meetings have been held frequently and continuously since the initial discussions to methodically plan, develop, market, and implement the TPAD program in Richmond County.

To demonstrate their strong support and commitment, the Richmond County Board of Education and Richmond Community College Board of Trustees held a joint dinner meeting to publicly announce their endorsement and to approve an articulation agreement between the two institutions. Orientation sessions on the TPAD concept, with heavy emphasis on futuring were held for all secondary and community-college staff.

DESIGNING THE TPAD PROGRAM

After the completion of staff-orientation sessions on the TPAD concept and futuring, a curriculum-development committee was organized for each of the vocational/technical curriculum areas to be articulated between the two institutions. (Curriculum-development, program-development, and staff-development activities were coordinated by the county director of vocational education, the instructional supervisors of the public schools, and the community-college deans of instruction and student services.) These committees involved teachers from grade nine through the community college—the first time most of the secondary and community college teachers had met jointly to discuss curriculum, articulation, gaps, and/or overlaps in instructional programs.

Initially these meetings were marked by tension and fear. Secondary teachers feared their programs would be abolished or moved to the community college. Community-college staff members were concerned that more high-school graduates would enroll in the college with advanced-placement credits, thus decreasing the number of courses needed and reducing staff requirements. Both the superintendent and the community-college president had to assure their staffs that the TPAD program would not mean a reduction in staff at either institution, but a redirection in program emphasis which would require significant staff inservice and retooling.

The curriculum-development committees were charged with:

- determining (with significant involvement of appropriate employers) the skills and competencies needed for completion of the associate-degree programs;
- developing an overall course of study from grade nine through the second year of postsecondary education, eliminating overlaps and closing gaps;
- establishing sequential academic and technological prerequisites; and
- determining advanced-placement criteria for high-school students who have mastered certain competencies.

Heavy emphasis was placed on helping high-school students develop a better understanding of mathematical and scientific principles and concepts in a technological laboratory setting, with much less emphasis on developing job-specific skills at the secondary level. Computer use was also emphasized.

Recommendations from the curriculum-development committees resulted in the discontinuation of some high-school vocational courses, the addition of new courses, and significant upgrading of many others. This, of course, required a tremendous amount of staff time during the year of planning prior to TPAD implementation.

In addition to the three curriculum-development committees, subcommittees were established for each career specialty included in the technology, business, and health clusters. These committees were challenged to review the academic prerequisites established by the curriculum-development committees and to make curriculum and instructional-program recommendations designed to motivate the "neglected majority" students to pursue and successfully complete more rigorous academic courses. One of the major concerns was the risk of failure involved in engaging large numbers of students in courses—such as algebra, geometry, advanced communications, and chemistry—which they would formerly have avoided. Thus, the committees had to address not only curriculum content and sequence, but also curriculum materials and mode of instruction.

A committee composed of secondary and community-college guidance counselors was also established to determine ways in which the "neglected majority" could be provided with the career guidance they need to assess their interests, aptitudes, and academic requirements and become fully aware of postsecondary technical education and career opportunities. This was one of the major areas in which the "neglected majority" had been underserved in Richmond County, while perhaps being the area of greatest need.

It was decided that students should be required to declare a course of study at the end of the eighth grade, choosing either a precollege, tech-prep, or general academic/vocational major. This requirement, which was intended to help students focus their academic and/or technological preparation, generated much discussion and concern that students would be "tracked" at an early age. This has not proved to be a problem, however. The Richmond County program allows students the flexibility of changing their course of study each year. Those who initially choose tech prep can easily shift to precollege the next year if their educational goals change—or to general academic/vocational if they find the tech-prep course of study too difficult. Those who designed the TPAD program felt strongly that students are better served by being encouraged to focus on a goal—even if they later change their focus—than by being allowed to drift with no academic/career direction at all.

RICHMOND COUNTY TPAD TODAY

After careful development entailing countless hours spent by committee members, the Richmond County TPAD curriculum emerged in its present form. As determined by the curriculum-development committees, each of the three TPAD program areas—engineering technology, business/entrepreneurship, and health/human services—builds on the same core of academic courses:

- Algebra I,
- Geometry,
- English (regular or precollege),
- Biology,
- Physical Science,
- Government and Economics, and
- United States History.

Students scoring at the fiftieth percentile or better on the California Achievement Test in math at the end of the eighth grade would be enrolled in Algebra I in the ninth grade. Students scoring between the thirty-fifth percentile and forty-ninth percentile would enrolled in Algebra IA in the ninth grade and Algebra IB in the tenth grade, thus having two years to master Algebra I concepts and skills. Students enrolled in the two-year Algebra I sequence enroll in Practical

Geometry in the eleventh grade. Health/human services programs require additional science courses. Cosmetology students are required to take Chemistry. Technical health occupations students must complete both Chemistry and Anatomy/Physiology. TPAD students may take Applied Communication at the senior level in lieu of senior English. Applied Mathematics is currently being studied to determine its appropriate place in the TPAD curriculum.

For students choosing the engineering-technology program, vocational/technical courses begin with Industrial Technology in the ninth grade. In the tenth grade, students choose between Introduction to Engineering Technology and Principles of Technology I, but must have completed Algebra I with a grade of C or better before enrolling in Principles of Technology I. Options increase in the eleventh grade to include:

- Principles of Technology I and II,
- Electronics I,
- Technical Drafting I,
- Auto Technology I,
- Metals Technology I,
- Textiles I,
- Graphics I, and
- Horticulture I.

Second levels of all the above courses are offered in the twelfth grade. Students completing the first level of Principles of Technology are given a unit of vocational/technical credit. When they complete the second level, they get a unit of credit in science, because the program is heavy in applied physics.

Upon high-school graduation, engineering-technology students may continue their studies in either architectural drafting, electronic servicing, machinist technology, electronics, mechanical technology, or industrial technology at Richmond Community College. Other options are available in other community colleges in the state.

Health/human services students begin the vocational/technical segment of their secondary education in the ninth grade with a course entitled Living Technology. In the tenth grade, they choose between Introduction to Health Occupations, Child Development, Foods and Nutrition, and Cosmetology I. Eleventh-grade course options include:

- Technical Health Occupations I,
- Child Care Services I,
- Commercial Foods I, and
- Cosmetology II.

The next level of each of the above courses is taught at grade twelve. As mentioned above, Chemistry is required for cosmetology students, and both Chemistry and Anatomy/Physiology are required for students enrolled in technical health occupations programs. Associate-degree programs in health/human services offered at Richmond Community College include practical and registered nursing and other health-care programs, human services technology, criminal justice, and cosmetology.

Business/entrepreneurship students begin their vocational /technical study with Introduction to Keyboarding/Word Processing I in ninth grade and continue with Computerized Accounting I, Marketing, and Pre-Computer Programming in grade ten. Eleventh-grade options for this course of study include:

- Computerized Accounting I and II,
- Advanced Keyboarding/Word Processing II,
- Computerized Business Data Processing I,
- Administrative Occupations I,
- Computer Programming I,
- Marketing and Merchandising,
- Business Law,
- Business Math, and
- Business Communications.

The twelfth-grade business/entrepreneurship curriculum includes a continuation of each of the above courses through the second level, plus a course in entrepreneurship. Business students may pursue accounting, business administration, business computer programming, or executive secretarial technology at Richmond Community College.

In each of the vocational/technical areas, heavy emphasis is placed on development of computer proficiency, an understanding of scientific and mathematical principles, and higher-order thinking skills. Students completing exit-level tech-prep courses upon high-school graduation and meeting course competency requirements established in the articulation agreement are given advanced-placement credit at the community college. This does not enable early completion of the associate-degree program, however, as the Richmond County TPAD program follows the skill-enhanced model rather than the time-shortened one. Additional advanced courses are added to the program so that graduates with advanced-placement complete their programs with advanced skills.

Career guidance is another major component of the Richmond County TPAD program. Each junior high school, in addition to the senior high school, is equipped with a computerized career-guidance center. Students have access to computer stations to conduct interest inventories on themselves, take a differential aptitude test, conduct a job or occupational search, or look for a college. A career-guidance file is kept on each student in grades seven through twelve to maintain information on that student's achievements, interests, aptitudes, and academic/career goals.

Vocational/Technical Courses	1985/86	1990/91
Living Technology	0	45
Food Science	0	15
Industrial Arts	228	0
Industrial Technology	0	175
Principles of Technology	0	73
Electricity	28	0
Electronics	0	53
Drafting	35	0
Computerized Drafting	0	66
Graphics	31	0
Computerized Graphics	0	25
Machine Shop	19	0
Metals Technology	0	26
Cosmetology	30	79
Typing	609	0
Keyboarding/Word Processing	0	486
Accounting	205	0
Computerized Accounting	0	181
Data Processing	0	78
General Health Occupations	64	10
Technical Health Occupations	0	62
Entrepreneurship	0	16
Applied Communication	0	39
Auto Mechanics	30	0
Auto Technology	0	17
Auto Servicing	0	16
Textiles	39	0
Textiles Technology	0	23
Total School Enrollment	1813	1701

Figure 2: Analysis of Enrollment in New and/or Upgraded Vocational/Technical Courses

Career-exploration units are taught at the seventh- and eighth-grade level to expose students to both the opportunities and the skill requirements (academic and technical) of the various occupational clusters. Prior to preregistering for ninth-grade courses, as indicated earlier, students are required to choose a course of study—precollege, tech prep (engineering technology, health/human services, or business/entrepreneurship), or general academic/vocational—with parental approval and signature. Students are locked to these choices for only one year at a time. Before each new year, students may change their course of study according to their career focus and/or academic achievement the previous year—but, again, only with parental approval.

Course-of-study choices are made only after extensive counseling sessions involving guidance counselors, teachers, administrators, and employers. Executives from local businesses and industries meet annually with groups of students in grades eight through eleven to inform them of rapid changes occurring in the workplace, job entry requirements, academic and vocational/technical skills needed, and job opportunities.

When registering for ninth-grade classes, students are provided with a color-coded registration card appropriate for their course-of-study selection. Upon completion of registration, guidance counselors cross-reference registration cards with course-of-study requirements and conduct follow-up counseling sessions with students to make adjustments if necessary.

MARKETING TPAD IN RICHMOND COUNTY

The task of motivating the middle majority of our students to pursue an academic and technological course of study which is much more rigorous than they normally would have taken was too big for the Richmond County public schools and community college to achieve alone. It was important to raise the entire community's level of sensitivity to the rapidly changing technology and the need for a better-educated work force. Better-informed parents, public officials, employers, and citizens at large could provide schools with a tremendous support system for guiding and motivating students. TPAD's marketing goal, therefore, was to saturate the entire community with the answers to "What Is Tech Prep?" and "Why Is Tech Prep Important to Richmond County?"

A strategic marketing plan was developed and implemented that has proved vital to the success of the Richmond County TPAD program. Over twenty thousand colorful brochures have been distributed each year to students, parents, civic clubs, employers, and various government and nonprofit organizations throughout the county. A speaker's bureau was established to provide programs on

TPAD for civic clubs, churches, and other groups. Employer representatives conducted large and small group meetings with students to impress on them the benefits and importance of TPAD. Breakfast meetings were held to update business and industrial executives on the progress of the TPAD program and to provide marketing materials for them to distribute to their employees.

Richmond County TPAD was periodically publicized in the local newspapers, especially prior to student registration; articles explained the "What?" and "Why?" of TPAD and outlined the entire TPAD curriculum on a full page. Ninety-second radio spots developed by high-school and community-college students were broadcast on all local radio stations. Cablevision programs were developed and broadcast before and after local football games.

The endorsement and support of local organizations proved invaluable to the TPAD marketing program. The Greater Richmond County Chamber of Commerce endorsed TPAD and included the program in promotional material. A local foundation offered twenty-five scholarships each year for five years to high-school tech-prep graduates. The local industrial development office also included TPAD in its promotional efforts. And the local newspaper published a twelve-page insert entitled "That's Progress" and hailing the Richmond County TPAD program as an educational pioneer.

Richmond County's experience indicates that marketing is vital to TPAD efforts. Implementation of a successful program depends absolutely on a knowledgeable and supportive community—and marketing is the activity that builds that knowledge and support base.

A PROGRAM THAT GETS RESULTS!

In fall of 1990, 32 percent of Richmond County high-school students are enrolled in the precollege course of study, 31 percent in tech prep, and 37 percent in general academic/vocational—a dramatic change from the 25-75 split between precollege and academic/vocational courses in 1986. Enrollment increases in precollege and tech prep were less significant in 1990-91 than in previous years. Nevertheless, the number of students enrolled in courses aimed at higher education has increased significantly in the four years since TPAD was begun in Richmond County. It has been estimated that, with adequate preparation at the elementary level, at least 75 percent of Richmond County students could function effectively in either precollege or tech-prep courses of study.

The percentage of high-school students completing Algebra I has increased from 47 percent in 1986 to 75 percent in 1990. Over the same period, the average end-of-course percent core score has increased from 53 in 1986 to 58 in 1990. This is one of the most significant documentations that our "middle majority" students in Richmond County can and will successfully master more advanced courses if motivated and involved in integrated academic/technical studies aligned with their career focus.

Course of Study	Grade 9	Grade 10	Grade 11	Grade 12
1985/86				
Precollege		25%		
Tech Prep		0%		
General/Vocational		75%		
1986/87				
Precollege		25%		
Tech Prep		0%		
General/Vocational		75%		
1987/88				
Precollege		39%	29%	
Tech Prep		17%	30%	
General/Vocational		43%	40%	
1988/89				
Precollege		40%	35%	36%
Tech Prep		25%	15%	16%
General/Vocational		35%	50%	48%
1989/90				
Precollege	30%	27%	34%	33%
Tech Prep	31%	32%	30%	20%
General/Vocational	39%	41%	36%	41%
1990/91				
Precollege	32%	31%	30%	31%
Tech Prep	32%	31%	26%	30%
General/Vocational	36%	38%	44%	38%

Figure 3: Course-of-Study Enrollment from 1985/86 to 1990/91

Yet another indication of success for the Richmond County tech-prep program: Average SAT scores of graduating seniors in Richmond County have increased 47 points since 1985. And the annual dropout rate from September to September for grades nine through twelve has decreased from 7.2 percent in 1985-86 to 4.8 percent.

A graduate follow-up survey conducted in January 1990 documented 27 percent of the 1989 graduates attending four-year colleges—as compared to 23 percent in 1986. Simultaneously, 40 percent were attending community colleges, as compared to 25 percent in 1986. Among the 1989 tech-prep graduates, 61 percent were attending community colleges and 5 percent were enrolled in four-year colleges (see figure 5).

Richmond County SAT Scores

1985	1986	1987	1988	1989	1990
772	778	795	816	819	819

(Includes best scores of Richmond Senior High School Graduates)

Richmond County Dropout Rate

1985/86	1986/87	1987/88	1988/89	1990 Goal
7.2	7.0	4.9	4.8	5.0

(Unduplicated Count)

Figure 4: Indicators of TPAD Success

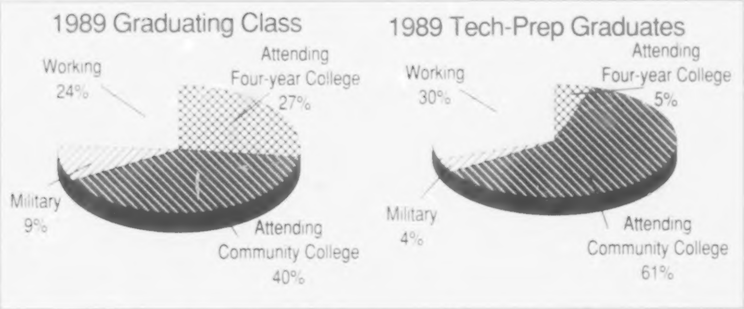


Figure 5: Postgraduate Placement in School and Workplace

THE VOICE OF EXPERIENCE: SUGGESTIONS FOR IMPLEMENTING A TPAD PROGRAM

The experience of Richmond County points to several requirements for planning, developing, and implementing a successful TPAD program. Among these are:

1. *Strong but participatory leadership.* Effective and responsible leadership must be exercised by all those involved in getting TPAD off the ground and keeping it running—in Richmond County's case, the superintendent of schools, the community-college president, both

boards, and administrators at both institutions. This leadership involves a redirection of educational programs, services and resources or a pruning of existing curricula and instructional programs associated with carefully planned, cultured new growth rather than just adding on new programs.

Strong leadership, however, does not mean authoritarian leadership. Dictatorial tactics will almost inevitably backfire. Those who have a vested interest in traditional programs must be convinced and committed through participatory decision-making to make the appropriate changes.

Implementing TPAD necessitates not only a change in educational values and perspectives among staff and students, but also among parents and the entire community. Thus, it is important to engage strong community leadership in planning, development, and marketing.

Because TPAD involves significant institutional changes, it would be counterproductive to hire additional staff to direct, coordinate and perform the planning, development, and implementation tasks. Institutional change requires the existing staff to change. Such change comes more efficiently and effectively through task forces, and quality circles, than through directives from "on high."

2. *Plenty of time to plan.* A minimum of one school year is needed for staff orientation, curriculum development and articulation, staff development, marketing the program, and guiding and registering students. Planning and implementation may also be done in phases over a period of two or three years. Marketing must be a continuous activity during this time period. Specific curricula and the overall program should be under continuous review to ensure appropriateness for emerging job-market competency requirements.

3. *A Funding Plan.* Developing and implementing a TPAD program is not cost prohibitive. Many expenses can be covered by reallocating existing funds. However, funds will be needed for curriculum and staff development and marketing. New vocational/technical programs may require expenditures beyond previous budgets because of the need for new, advanced equipment.[1]

4. *Specific Measurable Objectives.* It's hard to follow a successful path when you don't know where you are going. Developing and

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[1] Editor's note: Chapter 5 outlines some funding possibilities in more detail.

implementing a successful TPAD, therefore, requires established measurable goals to be achieved over a three to five-year period. Results should be carefully monitored and necessary refinements and adjustments made to keep program initiatives on course.

The results are in for Richmond County, North Carolina: TPAD works! All signs point toward continued success of the program, and other areas of North Carolina have followed its lead. Those responsible for establishing TPAD in North Carolina look forward to the day when TPAD takes its place nationwide as the technical education program of choice.

Preparing Health Workers In North Texas

David Ingram

Paris, Texas is a medium-sized North Texas town just a few dozen miles from the Oklahoma border and an hour or two away from Dallas. The huge Dallas-Forth Worth metroplex, in fact, provides a ready market for graduates from Paris Junior College's innovative TPAD Health-Occupations Project.

The purpose of the Paris project has been to develop a 2+2 TPAD program preparing students for careers in one or more health-related occupations. Initial emphasis has been on nursing because of the critical nurse shortage both in Texas and nationwide. The Paris curriculum has been specifically designed to provide for the development of salable skills in health occupations by the end of grade twelve and advanced employment in health occupations requiring less than a baccalaureate degree on completion of the curriculum at the associate-degree level.

Health careers were selected for the Paris TPAD project for three specific reasons:

- This vocational area—specifically nursing—was selected by the Texas State Board for Vocational Education as a priority for vocational education.
- The cooperating institutions serve a specific labor-market area in which the demand for health-care workers exceeds the potential supply.
- Most health occupations are technical in nature and provide a structured career ladder of occupations for which there is a common core of knowledge and competencies.

The Health-Occupations Project was cofunded by the Texas Education Agency and the Texas Higher Education Coordinating Board with funds provided by the Carl D. Perkins Vocational

Education Act, Title IIB. Paris Junior College and Paris Independent School District served as co-contractors, with the cooperation of Northeast Texas Community College and Mt. Pleasant, Marshall, and Atlanta (Texas) Independent School Districts. The eleventh-grade curriculum was implemented in the Paris, Marshall, and Atlanta schools during the 1989-90 school year on a pilot or experimental basis.

DESIGNING THE PROGRAM

The project staff for the Paris Health-Occupations Project consists of a principal investigator to coordinate project activities, an instructional-design specialist to coordinate and sequence project activities, a third-party evaluator, and four instructors—two secondary and two postsecondary who serve as curriculum writers/consultants. These four were charged with responsibility for the following tasks and activities:

- design and develop a TPAD articulated curriculum;
- develop competency profiles;
- develop a list of necessary supplies/equipment;
- develop basic course outlines;
- develop recommended student prerequisites;
- prepare a line drawing of a recommended instructional facility;
- develop a recommended set of teacher-approval criteria and;
- develop an evaluation, student monitoring, and follow-up system.

The first task of the curriculum writers was to identify and validate competencies for an articulated career-ladder curriculum in nursing. Then they had to determine which competencies would be taught in the secondary component (grades eleven and twelve) of the curriculum. It was quickly determined that a core of basic-skill competencies could be taught at the secondary level that would apply to the entire nursing-career cluster. In addition, these basic skills would be sufficient for attaining the first rung of the nursing career ladder—nurse's aide. TPAD participants would thus be able to exit the program at that point and later reenter to proceed up the career ladder to licensed vocational nurse (LVN), and registered nurse (RN).

An advisory committee consisting of members from the health industry, secondary and postsecondary institutions, state-level education agencies, and state licensing boards was established to provide technical assistance on the project. Their role was to provide input, suggestions, and recommendations, and to approve all project activities and products prior to submission to the appropriate state boards.

A subcommittee was established for the purpose of reviewing performance-evaluation criteria for entry-level workers. (It was recommended by the subcommittee and approved by the full advisory committee that an instrument indicating "satisfactory" or "unsatisfactory" performance of competencies be used and signed by the clinical supervisor.)

A PROFILE OF THE HEALTH-OCCUPATIONS PROGRAM

Several factors affected the specific features of the Paris Health-Occupations Project. In the first place, contract specifications called for a survey of regional health-care providers to determine priority occupations that would be included in the project. The survey identified the following occupations to be included in this TPAD project:

- nursing,
- medical laboratory technology,
- physical therapy, and
- radiology.

Of these four, the registered-nurse curriculum was specified as a priority and has been the only program launched as of this publication. Work continues on curriculum development for the other three occupations. Early experience with the nursing program indicates that there will be a common core of competencies for all four occupational areas that will be taught at grade eleven, some common competencies to be taught at grade twelve, with students beginning specialization in the twelfth grade through independent study and clinical specialization.

Other distinctive features of the TPAD health-care curricula are:

- a strong academic base,
- a competency-based curriculum,
- a career ladder, and
- an offering of advanced skills.

A Strong Academic Base

The project staff, with confirmation by health professionals and the advisory committee, determined that a basic core of prerequisites was essential for students preparing to enter into the TPAD health-occupations program. Strong emphasis was placed in mathematics, science, and communication skills.

Secondary Mathematics prerequisites for nursing are a minimum of three years of math beginning with Algebra I. Science prerequisites include Physical Science; Biology I; Chemistry; and Anatomy, Physiology, or Biology II. Other courses such as English and social sciences were not listed as prerequisites because the project staff and the advisory committee felt Texas state graduation requirements (four years of English and three and one-half years of social studies) were sufficient for students entering the TPAD program.

Postsecondary support courses for the TPAD program include Anatomy and Physiology I and II, Introduction to Psychology, College English, and Computers in Nursing, Chemistry, Sociology, Microbiology and Human Growth and Development.

A Competency-Based Curriculum

The Paris TPAD health-occupations program, like most other TPAD programs, emphasizes competency-based evaluation. This ensures not only that what is taught is based on the competencies of the workplace, but also that evaluation of the instruction is measured by student performance.

Students are informed prior to instruction of:

- the competency to be mastered,
- the conditions under which the competency will be performed, and
- the criteria to be used in measuring the performance.

Thus, students always have the security of knowing what is expected and understanding how those expectations tie in to actual on-the-job performance.

A Career Ladder

Health-career curricula such as those promoted by the Paris program are especially suited to the career-ladder concept. Exit points can be built in to these programs to allow students to leave and reenter without loss of credit.

Career-ladder clusters for the four specified occupations include registered nurse and the subordinate occupations of licensed vocational nurse and nurse's aide (see figure 1); physical therapy assistant and physical therapy aide; medical laboratory technician and phlebotomist; and radiologic technologist and radiologic technologist assistant.

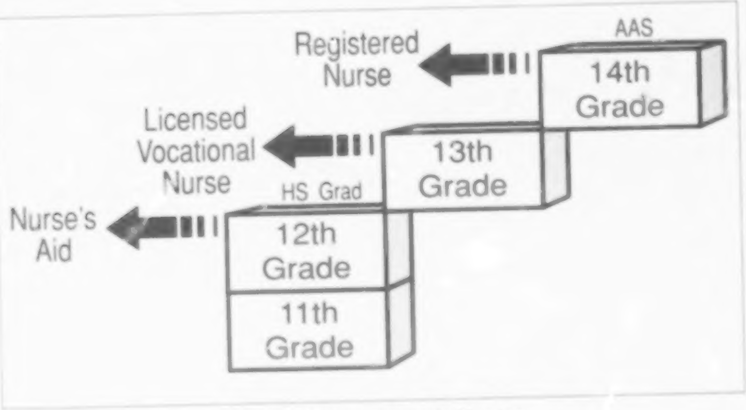

Figure 1: Career Ladder in Nursing

Exit points occur at grade twelve for the nurse's aide, phlebotomist, physical therapy aide and radiologic assistant and grade thirteen for the licensed vocational nurse. Reentry can occur at specified occupational levels.

Using the career-ladder approach in the development of this "2+2" articulated curriculum in health occupations benefits students and employers alike. For the students, it provides the opportunity to exit and reenter the program at specified occupational levels, interrupting educational advancement as necessary for financial, family or other reasons while still enabling progress toward the final goal. For the employer, the TPAD career-ladder ensures a better-prepared, specifically trained employee with higher competencies even at "lower" rungs of the ladder.

Advanced Skills

The Paris TPAD curriculum is an advanced-skills program rather than a time-shortened one. Skills not usually covered in generic curricula are taught, and content is enhanced or expanded.

For example, the course Nursing Process includes skills not currently in most LVN curricula. In addition, assessment techniques for LVN or RN content are covered in greater depth than currently taught in nursing programs.

The same holds true in other courses as well, with specifics relating to management concepts/competencies. In most curricula, these concepts and skills are taught briefly, but the TPAD programs allot more time to them.

SPECIAL NEEDS AND CHALLENGES

Many if not most of the characteristics described above also apply to other TPAD programs. This project differs from some other TPAD projects, however, in terms of some specific challenges to implementation. These challenges have shaped the development of procedures and practices.

First, developing the TPAD health-occupations program involved meeting requirements of independent State licensing boards such as the Board of Vocational Nurse Examiners and the Board of Nurse Examiners for the State of Texas. Both boards worked very closely and cooperatively with project codirectors and project staff as tasks and activities got underway. Because of the shortage of nurses, all parties realized the need to give and take on currently established rules and regulations in order for this TPAD project in health occupations to be successful.

Another particular challenge encountered was the need to develop a curriculum that would accommodate both TPAD and non-TPAD students so that postsecondary programs would not have to offer two separate programs.

Yet another challenge involved qualifications for health-occupations instructors in secondary schools. All secondary instructors for health occupations are certified by the Texas Education Agency, but not all of the instructors are registered nurses. Some postsecondary program personnel have expressed concern about the ability of such instructors to teach and verify mastery of nursing competencies in grades eleven and twelve. To meet this challenge, the project staff, with approval of the project advisory committee, developed a procedure whereby the secondary instructor who is not a registered nurse will verify mastery of the cognitive (knowledge) competencies and the supervising RN in a clinical setting will verify mastery of the performance (psychomotor) competencies. Verification of mastery of the cognitive and performance competencies will be documented on a student competency profile, which will become a part of the student's permanent record and will follow the student as he or she progresses through the articulated curriculum.

PROMOTING THE HEALTH-OCCUPATIONS PROGRAMS

For the Health-Occupations Project to be successful, it must be accepted by secondary administrators, directors of vocational education, middle-school and high-school counselors, and secondary health instructors. These in turn must promote and inform patrons of the community, parents, and students of the benefits and advantages of entering the program. The essence of marketing this particular program is to sell the concept that "you are starting to college in the eleventh grade."

Several means have been devised for carrying out such promotion. One idea is for project developers to provide technical assistance for postsecondary schools who ask for help in implementing similar programs. Details of this technical-assistance program are provided in a flyer mailed to administrators, counselors, and faculty. Postsecondary institutions who respond to the offer must ensure that two or more secondary schools will be represented when the technical assistance is provided. The meetings or workshops must be attended by deans or directors of vocational/technical education, deans or directors of nurse education programs, postsecondary counselors, secondary administrators, counselors, and health-education instructors.

Another important source of promotion for the TPAD program is the health-care industry. The critical shortage of health-care workers, especially nurses, both in Texas and nationwide, has made hospitals and other health-care institutions eager to swell the ranks of educated employees. They can almost certainly be counted on to support and promote the concepts and procedures of this project.

WORDS OF ADVICE—SUGGESTIONS FOR OTHER SCHOOLS ABOUT TO DEVELOP TPAD PROJECTS

Although at this writing the Paris TPAD health-occupations program is only in its second year of implementation, TPAD developers have already accumulated a wealth of advice to aid others who are interested in setting up similar projects:

- Make an effort to employ project staff who are committed to the project and who are willing to give more time and effort than their contract specifies, if necessary.
- If you are dealing with an occupation that requires licensing or certification be sure the licensing and certification agencies are

kept well informed of the project goals and objectives. Solicit their support and assistance.
- Research the literature in the appropriate occupational field to be aware of new developments and keep the curriculum up-to-date.
- Allow enough time to analyse, research, and develop tasks, activities, and specifications—don't move too quickly.
- Keep the program flexible at first—don't finalize a curriculum format in initial working stages. Issues and obstacles requiring changes will almost certainly arise.
- To achieve maximum benefits in a TPAD nursing program, be sure the articulated curriculum is approved and sanctioned by the state postsecondary board, the state education agency, state licensing boards and, if appropriate, the state department of health.
- Work to promote acceptance at the secondary level in order to recruit and encourage students to enter the program. This means there must be a high level of coordination and trust between the secondary health-occupations instructor and the postsecondary program directors and instructors.

Health care promises to be one of the high-demand career areas in the coming decades. As the general population grays and health care becomes increasingly technically oriented, the need for health-care workers will continue to soar. Programs like the Paris, Texas TPAD program will help fill that need with educated, competent, and qualified personnel.

2+2+2 Equals College Credit in California

Hank Padden

To understand the TPAD articulation effort in the State Center Community College District, one needs first to understand the makeup of the district. Included in its boundaries are seventeen separate school districts within fifty-five hundred square miles. Twenty-three high schools and two regional occupations programs feed into both Fresno City College and Kings River Community College.

The diversity of the schools in the district is tremendous—large metropolitan schools with culturally diverse populations; large suburban high schools serving middle- to upper-middle-class, predominantly Anglo, populations; small, rural high schools sitting on the agriculturally rich San Joaquin Valley floor and serving predominantly Hispanic populations; and small comprehensive high schools nestled in the foothills of the Sierras at the gateways to the Yosemite and Kings Canyon National Forests.

Both colleges in the district are well-established. In fact, Fresno City College, founded in 1910, is the oldest community college in California. Kings River Community College was established in 1926. Perhaps because they had been around so long, the colleges tended to rest on their laurels when it came to any kind of partnership with their feeder high schools. Then, in 1978, following the passage of Proposition 13, the "California Tax Cutting Initiative," the funding base for the colleges shrank, causing major cutbacks in programs all across the board. Efforts at outreach and articulation dropped off significantly to the point that enrollment at the colleges did not even reach the state-defined growth cap.

A NEW DIRECTION

During the 1985/86 academic year, however, the district took a turn in the direction of articulation. Under the leadership of the district's new chancellor, a strategic planning process took place which included discussion of articulation programs. Participating in this planning process, along with staff, were representatives of business, industry, chambers of commerce, the professional community, students, local K-12 school districts, and representatives from the local four-year colleges and state university. After nearly nine months of work, in August 1986, the district Board of Trustees adopted a five-year master plan of which the number-one goal was to "establish a high-school articulation plan which will encourage and facilitate the transition of students from high school to district colleges, resulting in a coordinated curriculum between these two levels."

The purposes behind that goal were:

- to reopen lines of communication with high-school students and to benefit them;
- to encourage high-school students to consider the colleges in the district as a postgraduation option, thus increasing college enrollments; and
- to begin developing a more meaningful approach to preparing young people for entry into the local world of work.

At about the same time, the chancellor's office of the California Community Colleges, along with the state superintendent of schools, sent out a letter inviting proposals for a planning grant to begin a 2+2 articulation program. In response, a group of secondary and postsecondary educators and administrators from the district put together a proposal for a fifteen-thousand-dollar grant.

Unlike most other articulation proposals, this one made no plans for developing articulation agreements between the various educational entities during the first year. The writers of the proposal chose instead to devote the entire planning year to developing a process which would work in any one of the diverse high school populations in the district—no matter how big, how small, how culturally diverse, how near or how far. The group also decided to pursue its articulation project regardless of whether it received state funding. Accordingly, no funds were ever committed to salaries other than provision of a stipend for selected instructors to attend summer workshops for purposes of developing and testing the process.

The writers of the grant proposal hoped to show the educational community that a cooperative posture by all educational institutions was the only way to serve students and that everyone—students included—benefits by working together. They also wanted to gain strong board leadership and support for an articulated 2+2+2 (two years secondary, a two-year associate degree, then completion of a baccalaureate degree). To that end, the group set out to demonstrate:

- that high schools, regional occupation programs, adult schools, community colleges, and four-year institutions could work together for the common good of students;
- that an articulated course of study would lead to a realistic skill level for students;
- that the private sector could be convinced that a TPAD partnership can produce adults ready for the job market;
- that, by working cooperatively, each institution could better utilize facilities and areas of expertise; and
- that a well-articulated program would strengthen students' confidence in the overall educational system, thus causing them to buy into the program.

Although the original request for proposals was for a 2+2 articulation effort, our 2+2+2 proposal was accepted and funded.

SETTING UP A STRUCTURE

Committees were quickly formed to provide leadership in getting articulation plans underway.

1. *A steering committee* included a board member and administrators from the State Center CCD and its two colleges; administrators from the project school districts; representatives from the county school superintendent's office, the four-year colleges, and the regional occupation program; and selected representatives at large. The steering committee's duties included:

- overseeing implementation of the project goals;
- providing inservice training for staff on the concept of 2+2+2 articulation;
- delineating which programs would be developed for implementation and articulation;
- coordinating the information from labor, industry, business, and education; and
- reviewing the model and disseminating it to all the schools in the district.

2. *A coordinating committee* was also formed. To lend continuity, the chairman of the steering committee also chaired the coordinating committee, which was made up of representatives from each of the project schools. The purpose of this committee was to involve teachers and counselors in the review of curriculum and the development of a competency-based curriculum, and to ensure that all school-site participants had a working knowledge of all existing vocational education programs at the colleges, the regional occupation program, and the high schools. Members of the coordinating committee also chaired the program-planning committee in their home districts.

3. *The planning committees* were made up of counselors and instructors from the high schools and the colleges. Representatives from these committees were to become familiar with their counterparts' programs, to develop the program components for the summer planning workshop at the end of year-one, and to develop a "generic" 2+2+2 vocational educational model.

Once the management structure was in place, representatives of the State Center CCD attended the board meetings of the project school districts to explain the project goals and to solicit resolutions of support committing time and resources to the project.

The State Center Community College District committed twenty-five thousand dollars over and above the grant funding during that first year to support the project. In April 1987, the State Center Board invited the board members and their spouses, district superintendents, curriculum managers, deans and associate deans from the colleges, and directors of guidance from the various high schools to a symposium entitled "2+2+2 Articulation: The Student's Key to Success." Almost four hundred people attended this symposium, which was conducted entirely by board members from the State Center Community College District. This demonstration of commitment by the Board of Trustees proved to be one of the strongest motivating factors in bringing the articulation concept to reality. Certainly, their personal involvement demonstrated that articulation between the various institutional entities was indeed a number-one priority.

SETTLING ARTICULATION ISSUES

Since the primary focus of year-one of the State Center CCD TPAD project was to develop a process which would work for all high schools and all vocational courses of study within the district, it was necessary to focus at the start on what was meant by articulation and to sell that concept to vocational instructors at the high-school, community-college, and four-year-college/university levels. Having determined that articulation is generally considered to be a systematic process that will permit students to move from one course, program, or educational level to the next without loss of time or resources; and that a guiding principle of articulation is that no student should be required to repeat the content of a course for which he or she has received credit, the steering committee agreed upon the following definition of articulation:

> Articulation is defined as a planned process linking two or more educational systems to help students make a smooth transition from the secondary level of occupational or academic training to the two-year or four-year postsecondary level without experiencing a delay or duplication of learning. Articulation is envisioned as a continuum of skills which may or may not lead to advanced placement.
>
> Armed with this definition, coordinating committee members were charged with in-servicing the respective vocational/occupational education teachers at each project high school and college campus on the concepts of articulation. Each participating instructor was provided with appropriate literature. Regularly scheduled review and discussion sessions were conducted on the separate campuses by coordinating council members to ensure prospective participants understood the 2+2+2 concept.

Readiness was the primary factor in determining which programs or courses would be articulated first. The steering committee determined early in the process that articulation would be forced on no one—and particularly not on the college-level instructors. Through regularly scheduled visits and informational exchange between instructors at the different levels, the steering committee hoped to develop enough mutual trust and respect that articulation would develop naturally.

Electronics, drafting, typing, keyboarding, and accounting emerged as the subject areas most ready and most likely to succeed in an articulated program. These five areas were the focus of the summer planning workshop held at the end of the first planning year. Six informal agreements were reached concerning articulation of these subject areas as a means of developing the articulation process. The process and the agreements were developed by instructors from the participating institutions during that workshop, but the choice of subjects and the ultimate process were subject to approval and/or modification by the steering committee.

The initial focus of the State Center CCD articulation agreements was competency-based instruction and complete articulation. Throughout the course of year-one and for the better part of year-two, the steering committee and coordinating committee focused on the types of problems that might be encountered in "selling" the concept of 2+2+2 articulation.

The major sticking point was that of issuing college credit for a course taught in high school. If college credit was to be awarded at all—and not everyone believed it should—how would the amount of credit be determined. And how would the course appear on the college transcript?

After months of discussion, the steering committee decided that if a course really was articulated, the college course was actually being taught at the high school. This meant a true competency-based program in place—that successfully completing the high school course was full indication of college-level competency in that particular course work. Additionally, if the college course was being taught at the high school, the student who successfully competed that course should be eligible for advanced placement in the program when he or she registered into the college.

Although the steering committee and the coordinating committee agreed on the "competency based" and "advanced placement" concepts, the curriculum committees on the separate college campuses still needed to approve them. Since the curriculum committees were involved throughout the process, and since they had to approve any agreements before those agreements could go into effect, the curriculum committees were the key to working out a system of credit.

College-credit agreements were approved on a high-school-by-high-school, teacher-specific basis to begin with. In addition, the curriculum committee required that a student, to receive college credit for taking an articulated course, must receive a grade of C or better in the high-school course, must be certified by the high-school instructor, and must complete twelve units of college credit once enrolled at the college, earning a C or better in that course work.

The student, upon successfully having completed an articulated course, receives a "2+2+2 certificate" from the high-school instructor, which he or she can present at the time of registration at the college. This certificate will be held in escrow until the student has completed the twelve-unit requirement at the college. Credit will then be entered into the official college transcript. The transcript will show the course title as it appears in the college catalog, the number of units noted in the articulation agreement, and the letter grade that the student earned when he or she took the course in high school. No special designation is noted on the transcript, since the whole philosophy behind the articulation process is that it is the actual college course—not a "high school version"—that is taught on the high-school campus. At this point, students can complete the equivalent of a full semester of course work while still in high school. The student is also eligible to receive high-school credit toward his or her high-school graduation while earning the college credit.

"SELLING" TPAD

Since the TPAD steering committee anticipated some resistance from the instructional staff, they decided to promote the 2+2+2 articulation concept vigorously from the very beginning—analyzing different target audiences and mapping out strategies for each. And even though the committee felt it was critical to get the college instructional staff on board, counselors at both the community-college level and the high-school level were targeted first. After all, these were the people who would persuade students for or against TPAD. During year-one, the committee met with several groups of counselors and shared with them a step-by-step presentation, using an overhead transparency, of what 2+2+2 was all about.

Next, the steering committee developed a set of video presentations—one of faculty talking to faculty, and one of students talking to students. Professional public-relations people were hired to script the videos and to make sure the videos would appeal to the target audience.

The student video, entitled *Fast Tracks*, was done in a Motown fashion, and the actors (students from a theater-arts magnet high school in the district) were representative of most school populations. A series of posters featuring "Eddie, Irene, and Loc," three cartoon characters, was developed for distribution in the high schools. Presentation folders were developed for counselors to give to students when they met with them. Book covers featuring the three lively cartoon characters were distributed among the thirty-plus high schools involved by that time. Cartoon strips featuring Eddie, Irene, and Loc and promoting the concepts of 2+2+2 were developed and provided for printing throughout the year in high-school newspapers (see figure 1).

All of these promotional materials were first presented to all counselors and high-school administrators at a symposium hosted by the State Center CCD at the local university in the fall of year-two, even though the first formal articulation agreement had yet to be signed.

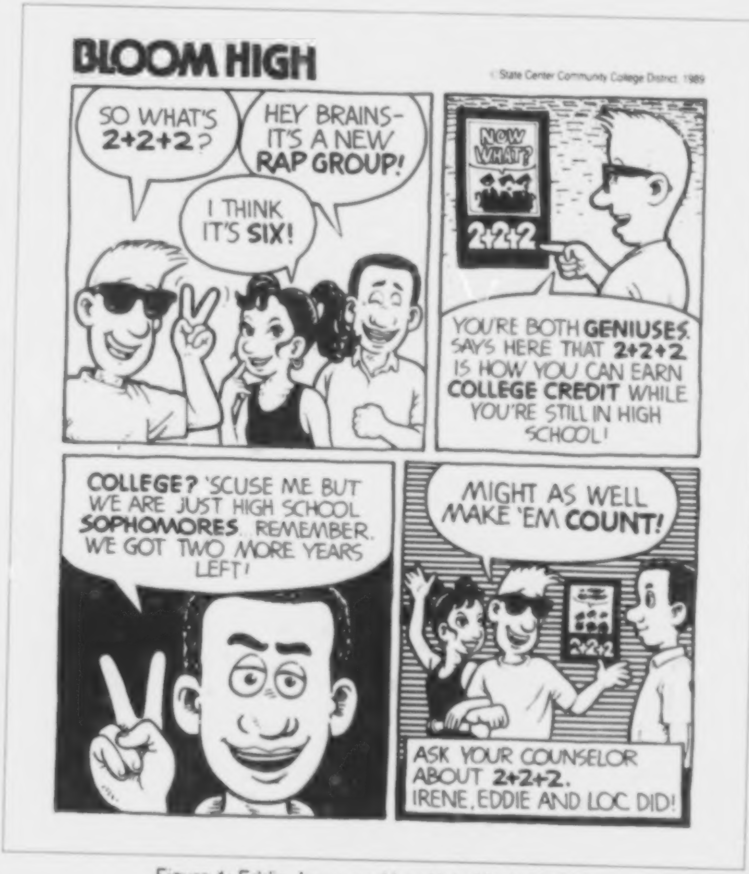
BLOOM HIGH
© State Center Community College District 1989
SO WHAT'S 2+2+2?
HEY BRAINS- IT'S A NEW RAP GROUP!
I THINK IT'S SIX!
NOW WHAT?
2+2+2
YOU'RE BOTH GENIUSES. SAYS HERE THAT 2+2+2 IS HOW YOU CAN EARN COLLEGE CREDIT WHILE YOU'RE STILL IN HIGH SCHOOL!
COLLEGE? 'SCUSE ME BUT WE ARE JUST HIGH SCHOOL SOPHOMORES... REMEMBER. WE GOT TWO MORE YEARS LEFT!
MIGHT AS WELL MAKE 'EM COUNT!
2+2+2
ASK YOUR COUNSELOR ABOUT 2+2+2. IRENE, EDDIE AND LOC DID!

Figure 1: Eddie, Irene, and Loc Help Market TPAD

The whole focus of the marketing effort was to make 2+2+2 so well known that it would become a household word along with *mother, flag,* and *apple pie.* The videos were featured on several television stations. Each high school had copies, which were shown in vocational education classes and were available in the career centers.

TPAD became so popular and so well known that parents and students began asking teachers about the program. No one wanted to be known as not supporting 2+2+2! The Business and Industry

Advisory Council even requested reports on the progress of the articulation effort at their quarterly meetings.

Marketing efforts were key in finally putting together formal articulation agreements. By the end of year-two, thanks to promotional efforts, six formal articulation agreements had been signed, and perhaps two dozen students had received certificates. By the fall of year-three, the number of requests for articulation agreements had picked up, and by the start of the Christmas break over one hundred thirty agreements had been put in place.

To further promote the process, a directory was developed that listed the agreements by high school and by college. The table of contents listed a page for every high school and college in the district. For those having completed no agreements, their designated page read, "No agreements completed at this time." The directory was distributed to all counselors, high-school principals, district superintendents, and school boards within the State Center CCD service area. It was not long before the reluctant ones joined the articulation effort.

The promotional effort went over so well that the college-prep programs began to join the fold. A student may complete the English requirement for graduation from one of the district colleges while he or she is still in high school.

TPAD PROGRAM RESULTS

Excitement has remained high since the State Center Community College District TPAD program got underway. Communication among high schools, community colleges, and four-year colleges is at an all-time high. The original set of five pilot districts and eleven pilot high schools has expanded and now includes twenty-two separate school districts (four of which do not fall within district boundaries), twenty-nine different high schools, and two regional occupation programs. Fresno State University and Fresno Pacific College are also active partners. Superintendents have reported that some high-school instructors whom they felt were just waiting for retirement have done about-faces and now are recognized as some of their top instructors. There is great pride in working together.

Key to the success of the program is the fact that, from the very beginning, TPAD planners made sure everyone would benefit in some way.

For the student, articulation minimizes needless duplication, allows him or her to earn college credit while in high school, and provides the incentive to continue on to the community college and pursue advanced technical/vocational education. Students gain self-confidence while in high school; the realization that they already have a head start on college makes their course work seem more relevant.

For instructors at all levels, articulation means knowing firsthand what is happening at the other levels. Instructors see an integrated program which encourages continued education. There are renewed cooperation, understanding and respect among instructors. Teachers at all levels have become more positive as they see that what they are teaching is connected at all levels of education and connected to the real world. There is a real sense of pride based upon improved student success.

The institutions benefit in that the program allows for the sharing of facilities and equipment. The concentration of equipment, staff, and facilities makes it easier to keep abreast of "state of the art" technology. The colleges benefit from a ready pool of capable part-time instructors (the high-school faculty), and enrollments are increasing dramatically at the community colleges. Everyone involved believes in the 2+2+2 concept. A true partnership has evolved which shows no sign of dissolving.

WORDS OF ADVICE

As other schools embark upon putting articulation programs together, they need to take the time to define clearly what it is they want to accomplish. There is a tendency to want to rush right out and get some instructors from the different educational institutions working together to develop a formal agreement simply because they have worked together informally for years. That is natural, of course, because we are a "results oriented" society. Such an impulse can work against successful articulation, however. Developers of the State Center CCD plan insisted on establishing a process that would ensure that specific articulation agreements will survive any one individual (instructor, steering-committee member, or administrator) leaving. Institutionalization of the process should be built in from the very beginning.

Money should not be a stumbling block; TPAD programs can be run without significant outside funds. In fact, any seed or grant money that is available should be earmarked for nonrecurring expenses rather than normal TPAD operation. If articulation is important, it should become a normal part of the budgetary process, not an expensive add-on.

In retrospect, the State Center CCD probably could have done a better job of involving total college faculty in the beginning.

Concentrating almost exclusively on vocational and technical instructors probably slowed down the implementation of the other programs at the college level.

Remember, board and administrative support is critical, but instructors, counselors, and students are the folks who are going to make TPAD work. This means it is vital to provide the time for instructors from different levels of schools to build trust and solid working relationships before they are required to forge articulation agreements. If problems are handled directly, everyone involved will usually work together to solve the problem. A good rule of thumb for everyone is: If it is good for students, it is bound to be good for the system.

Annual evaluation of every articulation agreement is very important. This not only ensures quality control; it guarantees ongoing communication among the instructors who initially developed the agreements. A formal evaluation should be conducted every three years to keep an agreement valid.

UNIQUE ELEMENTS OF THE STATE CENTER CCD PROGRAM

The State Community College District TPAD program was unique in that the articulation *process* was its primary focus. TPAD developers knew that if they could develop a system in which teachers could work together, enjoy regular contact, and keep flexibility within an overall structure, people would buy into it.

Communication, therefore, was the key emphasis of the program. Every effort was made to ensure that whatever was discussed at steering-committee meetings was communicated back to the instructors and counselors at the separate campuses.

A repository of all articulation agreements signed as a result of the program has been established at the Regional Occupation Program Center so that any high-school teacher or department may compare the course they are preparing to those which have already been articulated. This process is helping to standardize high-school courses, avoiding loss of time when a student moves. A student transferring from one high school or school district to another participating high school simply picks up where he or she left off in the articulated course.

Teachers in the State Center CCD high schools advertise their courses with a calling card which reads, "2+2+2—This course equals college credit now"—and students flock to those courses. In central California, the 2+2+2 program itself is successfully promoting 2+2+2!

Setting the PACE in South Carolina

Diana M. Walter

TPAD began in 1986 for South Carolina's Anderson, Oconee, and Pickens counties. In this mostly rural area, tucked into the state's northeastern corner, local business and education leaders came together to discuss a newly launched idea in education—the so-called "2+2 tech prep" concept. The meetings centered around whether TPAD could effectively address a number of problems facing the local community.

After several months of discussion, members concluded that TPAD offered considerable promise for alleviating several educational problems facing the community:

- the high dropout rate,
- the lack of curriculum and career focus for high-school students in the general-education program,
- comparatively low numbers of recent high-school graduates entering associate-degree programs (with approximately 50 percent of those requiring remediation), and
- a serious shortage of associate-degree graduates to meet the growing demands of area employers.

In order to move from interest in a TPAD program to actually developing one, the group members formed a business/education partnership called PACE—the Partnership for Academic and Career Education—in May 1987.

LAUNCHING THE TRI-COUNTY TPAD PROGRAM

A coordinating board and a working structure were then established to facilitate the development of Tech Prep/Associate Degree programs. Board members included the seven school superintendents, six business leaders representing some of the area's largest employers, the assistant director of the National Dropout Prevention Center at Clemson University, and the president of Tri-County Technical College. Since that time, the PACE coordinating board has retained its original focus with only minor changes.

Administration for the PACE partnership was provided initially by Tri-County Technical College. In 1987, a member of the college staff was released from regular duties to serve part-time as PACE executive-director, and clerical support was provided through the college's division of institutional development. In October 1987, a three-year grant was received from the United States Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE) program. A full-time secretary and a curriculum developer were then hired to implement the grant objectives previously endorsed by members of the PACE coordinating board. A curriculum committee was also established, comprised of district-level curriculum coordinators, academic administrators from the college, and area vocational directors.

FINE-TUNING THE PROGRAM

The first TPAD design proposed was a 2+2 program focused on four separate career-cluster areas:

- industrial/engineering technology,
- business,
- health, and
- public service.

Students currently enrolled in general-education programs would choose one of these four areas, each of which involved applied-academics courses as well as new general-technology courses to build a foundation for career-related skills. The program was slanted specifically toward attainment of an associate degree in one of the four target areas.

This early model raised a number of concerns during the 1987-88 year. Public-school leaders concerned with high dropout rates disagreed with plans to begin TPAD in the eleventh grade; they felt many potential students would be "lost" without earlier opportunities to enroll. Some college faculty who were coordinating certificate or diploma programs felt that excellent opportunities awaited graduates with less than an associate degree. Several public-school administrators voiced concern over the costs associated with implementing four new "tracks." And some counselors worried that students might be prematurely channeled into making career decisions.

Local vocational educators were particularly concerned about the new model. They feared problems with enrollment—both tech-prep and vocational education would be "recruiting" from the same pool of general-education students. They also feared that new technology courses would, in many respects, overlap with current vocational offerings. Several vocational-education leaders, in fact, felt they could not actively support the development of a TPAD program unless their misgivings were addressed effectively.

In response to these concerns, the PACE staff began reevaluating the design model. After extensive discussions with school and college representatives, some significant changes were made during the 1988-89 academic year. The TPAD program design was modified to begin in the ninth grade and end with completion of a postsecondary certificate, diploma, or associate degree (or provide the opportunity to exit after grade twelve with enhanced employability skills). To reflect these changes, Pace staff modified the TPAD program title to Tech Prep (Preparation for Technologies).

Rather than four separate "tracks," one comprehensive tech-prep option was proposed that used enhanced academic courses with career-related applications from all clusters interwoven throughout grades nine through twelve. Tech-prep students would also take vocational or occupational courses targeted toward their career and postsecondary-education goals. These courses would provide a technology skills base and would be taken in combination with the courses providing higher-level academic skills. This change in program design essentially increased the target population for tech-prep programs to involve general as well as vocational-education students (as much as 75 percent of the total high school enrollment in some cases).

Another concern voiced by members of the coordinating board and the PACE curriculum committee was that counseling issues had not been identified and adequately addressed within the working structure of the organization. To resolve this concern, at least in part, a counseling committee was formed in the winter of the 1988-89 academic year and an third staff member, released half-time, was provided by the college. With these basic changes communicated and in place, and with the director and curriculum developer now working full-time on the project, the development of TPAD programs began to take off in the tri-county area.

One of the changes made in 1988 that has enabled swift and significant progress is the way in which the PACE staff works in program development and implementation. The staff came to realize that TPAD programs would not be uniform across all seven school districts, that variation in the size and resources of each district would have to be considered carefully, and that the secondary components of each program must be "owned" exclusively by the local district. This means that the PACE staff works as part of a development team identified by each district to design programs that fit the specific needs, interests, and resources of the local district. While the basic TPAD concept remains the constant, there is considerable variation in how programs are designed and implemented across districts. This flexible approach to program design has resulted in some innovative program components developed by individual districts and often adopted by others. Several examples will be described later in this section.

THE PACE MODEL TODAY

Even with great variation in how districts approach the development of their programs, and with the seven districts currently in various stages of planning and implementation, the PACE partnership retains twelve common goals for fully developed tech-prep programs:

- to enhance the academic levels of high-school math, English, and science courses in the general-education program;
- to increase students' motivation to learn academic concepts by using career-related examples from business, industrial /engineering technology, health, and public-service fields in teaching math, communications, and science courses;
- to provide a coordinated, sequenced series of academic and vocational courses starting in grade nine and continuing through completion of an occupational certificate, diploma, or associate-degree program at a technical, community, or junior college;
- to motivate students to graduate from high school by making their secondary studies more "hands-on" and relevant to the world of work;
- to raise the self-esteem level of general and vocational-education (tech-prep) students by enabling them to identify with a program that has direction, status, and visible support from local employers;
- to encourage students to develop a technology skills base by completing high-school vocational/occupational courses;
- to increase students' level of academic and vocational preparedness to enter a college occupational-degree program

without remediation or to enter the work force directly after high school with enhanced employability skills;

- to motivate more high-school students to pursue postsecondary education by enabling those who qualify to earn Tri-County Technical College credit for equivalent vocational/occupational or academic courses in high school (technical advanced placement);
- to increase students' understanding of mid-level technology careers and their ability to set realistic career goals through material presented in applied courses and specialized counseling activities;
- to provide clear, concise information to high school counselors, teachers, students, and parents on the preparation needed for two-year college programs and on the careers available to graduates;
- to encourage implementation of industry-sponsored programs providing relevant part-time employment and tuition assistance for TPAD students entering two-year college programs (see the section on mentoring in chapter 8 for more information about how employers can contribute to TPAD efforts); and
- to increase the number of graduates from two-year occupational-degree programs—and thereby the number of potential workers for the local work force—who possess technical (job-related), academic, and critical thinking skills.

The PACE model for TPAD programs has evolved into a very comprehensive approach involving secondary/postsecondary curriculum reform, extensive counseling and career education, and numerous links to the business community.

Implementation of the program begins in the middle-school grades, with emphasis on understanding mid-level technology careers (that is, careers requiring job-specific training or up to two years of postsecondary education for job entry and/or advancement). This career information is imparted through course work, field trips, guest speakers, and other school-based activities.

When the student enters high school and elects the tech-prep option, he or she takes enhanced math, English, and science courses in which academic concepts are taught using applications from the four career clusters (industrial/engineering technology, health, public service, and business). Academic courses in the tech-prep program may be professionally developed (such as the CORD/AIT courses) or locally developed/enhanced by teams of college, high-school, industry, and PACE representatives.

Rather than choose a specific career cluster, tech-prep students receive exposure to careers in all clusters through their academic course work. Students then customize their preparation through the selection of vocational/occupational courses, some of which may begin as early as the ninth grade.

To help students combine academic and vocational course work successfully and position themselves to take advantage of opportunities such as advanced-placement and tuition-assistance options for college, several districts have published tech-prep guides which suggest curriculum choices, beginning in grade nine.

When tech-prep students become high-school seniors, they may participate in the Technical Advanced Placement (TAP) component of their TPAD program. TAP enables qualified students to earn Tri-County Technical College credit based on their vocational (and selected academic) course work and completion of specific procedures. These procedures may involve competency checklists, examinations, transition courses, or other validation methods. Credit awarded through TAP can be applied toward meeting graduation requirements in certificate, diploma, or degree programs. Thus, TAP results in a time-shortened curriculum, although some students may choose to carry lighter course loads and complete the program in the full two years.

UNIQUE FEATURES OF THE PACE PROGRAMS

Prior to the 1990-91 academic year, postsecondary curriculum development in the PACE program was limited to reviewing entry-level skills and smoothing the transition from the secondary to the postsecondary levels of education. Beginning in fall of 1990, however, the college faculty and the PACE staff began developing "advanced technology certificates" to enable tech-prep students to graduate with two postsecondary credentials in the time it would normally take to finish an associate degree. These certificates were developed for Machine Tool Technology and Office Systems Technology curricula, which previously offered only time-shortened study.

PACE and college officials see this as a cost-effective way to offer students a combined time-shortened and skill-enhanced option for their college studies. While the "combination" certificates will be optional, it is anticipated that students will see them as a way to gain a competitive edge in the job market.

As mentioned earlier, each district's tech-prep program is designed individually. This flexibility and the creativity of many school districts have resulted in some innovative approaches to TPAD programs. They include:

- a tech-prep component called technical advanced study which enables qualified students to enroll in college courses during their senior year,
- an entire curriculum centered around two options, colleges prep and tech prep, with remedial students provided with special classes to bring their skills up to the levels required by the state's exit exam,
- a comprehensive career-preparation program with either a two- or a four-year college focus that begins in middle school and involves extensive career counseling and assessment as well as advanced placement, tuition assistance, and possible employment options upon graduation, and
- enhanced curriculum options for tech-prep students in math, science, and other academic areas. (Crescent High School was among the first in the state to offer the Principles of Technology course.)

While each of the seven districts in the tri-county area currently has one or more aspects of tech-prep functioning, planning and development remain ongoing. Pickens County Schools, a large district with four high schools, is currently developing a comprehensive tech-prep curriculum option. Smaller districts such as Anderson One and Two also are adapting the tech-prep concept to meet their needs and will implement courses such as Principles of Technology and Applied Communication during the current school year.

PACE'S MARKETING STRATEGIES

The promotion and marketing of all TPAD programs in the tri-county area are coordinated on two levels—on a regional level through activities of the PACE office, and on a local level through the various districts and schools, often with assistance from the PACE staff. Regional activities have included:

- the design of a program logo;
- a career-exploration brochure highlighting mid-level technologies;
- newspaper articles;
- quarterly newsletters featuring successful practices; and
- numerous presentations to business, education and community groups.

And local marketing efforts have made good use of:

- inservice workshops for all faculty and staff,
- publications such as TPAD guides,
- flyers and inserts mailed to parents, and
- informational meetings for parents.

Perhaps the most effective marketing strategy has been simply to provide parent, student, and school groups with information on the "TPAD payoff"—the careers, salaries and advancement opportunities available in mid-level technology careers.

The PACE TPAD initiative has benefited considerably since 1987 from the active support and assistance of area employers. For example, most of the local curriculum work has involved taking job-related examples supplied by local employers and developing them into practical applications for academic courses. Approximately eighty area business professionals have participated in a speakers' bureau, volunteering their time to share career information and educational requirements with students, faculty, and staff. And employer representatives also participate on all PACE committees, provide tours for teachers and counselors, and often participate as featured speakers at inservice sessions and TPAD workshops. Tri-County Technical College faculty, staff, and administrators also have provided PACE with exceptional support and have been major contributors to the success of the TPAD initiative.

MANY STEPS TAKEN; MANY LEFT TO TAKE

Although the TPAD initiative in Anderson, Oconee, and Pickens counties is still too new to draw empirical conclusions on student outcomes, there have been notable changes nevertheless. These changes have occurred in structures, in curricula, and in attitudes—the type of changes that will, without question, result in the desired outcomes and benefits for both students and the community. While the flexible development approach taken by PACE slows down opportunities for summative analyses, it increases the likelihood that TPAD programs will become integrated, substantial components of both secondary and postsecondary offerings.

The philosophy of the PACE partners is that with more relevance in course content, more focus on high-school study, and better information on the "payoff" of an education, more students will successfully complete high school, finish college programs, and enter the work force as productive, competent employees. To reach these goals, the PACE partners look at TPAD as a long-term investment, believing that a short-term "fix" is neither possible nor worthwhile.

Despite the progress made since 1987, a significant amount of work remains to be done on TPAD in the tri-county area. Teacher training is generally recognized as a top need. While many excellent teachers work in tri-county schools and many have embraced TPAD techniques, many others cling to more traditional techniques. And academic teachers need help in understanding more about the careers from which practical applications are derived. Counselors need improved training as well in order to understand the careers targeted by TPAD and the requirements of the technical, community, and junior-college programs which provide training for those careers.

These professional training needs are understandable. Teachers and counselors are, after all, successful products of a traditional education and so can be expected to be comfortable and loyal to traditional programs. In addition, many mid-level technology careers are relatively new and are changing constantly with advances in technology. Helping teachers and counselors keep up is likely to remain an ongoing issue for TPAD programs of the future. The PACE staff also recognizes that more activities for parents must be developed so they will be more effective in helping their children take better advantage of high-school offerings and opportunities that were nonexistent just a few years ago.

The PACE TPAD program has been evolving and growing in Anderson, Oconee, and Pickens counties since its inception—and its growth will in all likelihood continue. PACE's flexible approach to program development allows programs to be designed in ways that are cost-effective and realistic for both secondary and postsecondary institutions. The curriculum model is distinctive in that it enables both time-shortened and advanced-skills opportunities. And efforts are well underway to support all aspects of the tech-prep curriculum with effective counseling, career information, and active involvement by the local business community. Although far from a finished story, TPAD is well on its way to making futures brighter for students in the tri-county area.

A TPAD Summer Program in New Mexico

Sam Vigil

For over forty years, New Mexico has been the site of some of this country's most sophisticated technical achievements in defense, aerospace, energy, and laser/electro-optics technologies. Government funding through military bases, Department of Energy National Laboratories, subcontractors, and "technology spin-off" companies have resulted in an unusually large concentration of highly educated and creative scientists, engineers, and technicians. But nearly all of this technical work force has been "imported" from other states because relatively few native New Mexicans have the technical education and skills to qualify for the high-level (highly paid) jobs created in this technical complex.

Attempts to reverse this trend depend upon education and training to achieve a high level of "technological literacy" among the New Mexico natives, many of whom are Hispanics and Native Americans. TPAD programs—especially the high school "tech prep" component—represent one excellent way to to provide this training. But outside of Albuquerque, many of New Mexico's high-school students are enrolled in small-population schools located in remote, rural communities. And many of these schools simply cannot afford to provide tech-prep programs to the relatively few students who could benefit from them.

TPAD curricula generally require that secondary institutions provide more and stronger math and science for their "forgotten half" students and that these students be motivated to continue their education/training after high-school graduation in technical associate-degree programs. These requirements are frequently achieved at the secondary level through applied-academics courses, which require specifically trained teachers and adequately equipped laboratories (costing twenty to forty thousand dollars). These are resources that small, rural schools—who may have only six or eight potential TPAD students per grade level—often cannot justify.

Community and technical colleges have attempted to assist in delivering applied academics in such situations by one of three methods:

- teaching applied-academics courses at the college campus to high-school students commuting part-time (this option is most successful when the commuting distance is less than twenty miles);
- distance learning, utilizing technology such as satellite television (this is most successful when labs can be conducted by a local facilitator with equipment) and;
- summer programs in which students from nearby communities travel daily or weekly (staying in dorms) to the college to receive the applied-academics instruction.

A highly successful example of such a summer program is the one at Luna Vocational Technical Institute in New Mexico.

INTRODUCING LVTI

LVTI is a two-year postsecondary institution located in Las Vegas, New Mexico. Its campus lies on the lower slopes of the majestic Sangre de Cristo Mountains, facing the vast plains that stretch eastward toward Texas, Oklahoma, and Kansas. For the past twenty years, LVTI has addressed the multifaceted educational needs of students from northeastern New Mexico who have sought careers and training in the vocational and technical areas of industry, business, and various health fields.

Although LVTI's service area contains 25 percent of the state's geographical land mass, only 12 percent of the state's total population resides within its rural boundaries. The area is also the most economically depressed in New Mexico. The majority of the residents are indigenous Hispanics who have had minimal exposure to the educational and occupational opportunities offered by contemporary society.

The student body at LVTI is comprised of 86 percent Hispanics; 34 percent of the student enrollees come from families with annual incomes of three thousand dollars or less, while 65 percent come from families with incomes below twelve thousand dollars. Of the counties which lie within the service area, Mora County is the poorest, with an unemployment rate of 32 percent, the average unemployment for the total service area is 20 percent. At least 20 percent of the students who enroll in the school have not completed high school.

LVTI persists in serving these people at a time when the need for well-paying jobs is greater than ever—and at a time when many of the fastest-growing job opportunities require more than a high-school diploma but less than a university degree. The certificate and two-year-degree options provided at the Institute are designed to prepare students for quick entry into high-tech job markets.

This ongoing effort fits in with a more recent emphasis of the New Mexico State Department of Education, Vocational-Technical Division. During the past three years, this division has been encouraging postsecondary schools to participate with secondary schools in articulated programs. The intent of the State Department of Education and the secondary and postsecondary institutions is to restructure high-school vocational technical curricula in a way that provides more instruction-related applications in basic math and science, thus relieving postsecondary schools of the need to repeat basic instruction and allowing students to concentrate on increasing their proficiency and understanding of technical concepts in postsecondary schools.

LVTI's continuing interest in equipping students for a changing job market, combined with the more recent State Department of Education directives, has led LVTI to coordinate planning and curricular programming with the high-school districts that lie in the northeastern quadrant of New Mexico. While the Institute serves this entire vast area of the state, its 2+2 articulation effort has focused on six school systems which support the school through a tax base. These include the West Las Vegas Municipal Schools, Las Vegas City Schools, Santa Rosa Consolidated Schools, Mora Independent Schools, Springer Municipal Schools, and Maxwell Municipal Schools. LVTI has made a special effort to establish programs that will prepare high-school students from its service area for entry into technical and community colleges.

During the past three years, the Institute has established 2+2 programs for public schools in the following instructional areas:

- Applied Mathematics (taught through instructional television),
- MESA Science and Engineering,
- Welding,
- Computer Aided Drafting,
- Principles of Technology,
- Nurse's Aide, and
- Allied Health Fields (including Medical Lab Assistant and Dental Assistant).

LAUNCHING SUMMER TECH PREP AT LVTI

During the summer of 1989, responding to the needs of the six participating school districts in the immediate service area, LVTI embarked on a pilot TPAD program based on a summer tech-prep component for high-school students. This program, which was designed to help students prepare for scientific and technical energy-related careers, was so successful that it was repeated in the summer of 1990. Plans have been made to continue the program during succeeding summers—as long as resources are available.

Partial funding for the first two tech-prep summer programs was provided through the United States Department of Energy Minority Honors Training and Industrial Assistance Program. (LVTI's contribution to the program is approximately 70 percent of the total cost.)

LVTI is one of eight schools in the nation participating in this national program, which provides scholarships and opportunities for cooperative training to minority honor students pursuing postsecondary education in high-technology areas and energy-related careers. Funded by the DOE's Office of Minority Economic Impact, the Honors Program has allowed LVTI to establish links and partnerships with seventeen major industries and national laboratories that provide career opportunities, assistance with curriculum development, equipment donations, and cooperative and specialized training for postsecondary students. Some of the participants in this program are Sandia National Laboratories, Computer Sciences Corporation, BDM International, Digital Equipment Corporation, Sparton Technology, Motorola, EG&G, and General Electric.

The DOE Minority Honors Program Federal Grant was not specifically provided for a summer program such as the one at LVTI. However, the Department of Energy responded favorably to LVTI's request to use its funding for this purpose. With such funding support in place, plans were quickly carried out to implement the first program during the summer of 1989.

THE FIRST YEAR: 1989 TECH-PREP SUMMER PROGRAM

The first tech-prep summer program proved to be an excellent example of how a postsecondary institution can articulate programs successfully with secondary schools. (In addition to the six high-school districts mentioned earlier, another school district, Wagon Mound Public Schools, was able to participate in the summer program.) The primary focus of the program was to provide new opportunities for those mostly Hispanic high-school students and to allow 1989 high-school graduates to prepare for scientific and technical energy-related careers.

This first summer program also allowed LVTI the opportunity to enhance and strengthen its ties with private high-tech industries and national scientific laboratories. During the course of the program, high-tech industry and laboratory personnel were actively involved in providing scientific and technical demonstrations and tours for the participating students.

Twenty-two high-school students participated in the first tech-prep summer program. They attended four- to six-hour day sessions throughout the eight-week program and were able to complete Principles of Technology, an applied physics course (see chapter 3 and appendix B). The students also had the opportunity to enroll in selected technology classes, including computer programming, electronics technology, drafting and design technology, and laser/electro-optics. Courses utilized state-of-the-art instructional systems, audiovisual presentations and demonstrations, and laboratory experiences. Students were provided with texts and a minimal monetary allowance. A series of tours and field trips to scientific institutions and industries was conducted, along with on-site technical and scientific presentations, lectures, and demonstrations by industry and laboratory personnel.

Student participants for the program were selected upon recommendation by instructors and counselors from the participating school districts. Minority students with a strong interest in science and technology were given primary consideration.

The students who successfully completed the program received credit toward an Associate in Applied Science Degree or a certificate in the technology training programs offered at LVTI. Some students were also granted credit from their respective schools to fulfill high-school graduation requirements.

THE SECOND YEAR: THE 1990 TECH-PREP SUMMER PROGRAM

By the beginning of summer 1990, word had spread about LVTI's tech-prep summer program. The program more than doubled its enrollment from the previous summer—a total of fifty-one students. Among the students recruited were academic scholars ranking as high as number-one in their classes, National Honor Society members, as well as a number of outstanding students who had been selected to represent their schools at American Legion's Boy's and Girl's State.

Most students in the 1990 summer program enrolled in Principles of Technology I, although students who had participated in the program during the previous summer were able to take Unified Technical Concepts (applied physics for technicians). Students again had the opportunity to take an additional elective.

All students who successfully completed the program received a full high-school credit that could be applied toward a science or math requirement, in addition to credit toward an associate degree. Those who took an additional elective were also able to receive additional high-school credit in math, electronics, computer-aided drafting, computer programming, and laser/electro-optics.

RESULTS OF SUMMER TECH PREP AT LVTI

LVTI's tech-prep summer program has been especially successful in stimulating interest in science and high-technology careers among high-school students. This has been clearly evident in the increasing number of students who are seeking entry into the program. Summer tech prep has received strong support and accolades from students, public-school teachers and administrators, and the community as a whole.

All tech-prep summer students, at the conclusion of their summer stay, participate in a final evaluation of the program. And all have expressed satisfaction with the program's overall mission of preparing them for scientific and technical energy-related careers.

Most of the students have found the program itself challenging and compelling, especially with respect to the "hands on" lab experiments which allow them time to probe and explore on their own. They have also benefited from the ability to concentrate in one specific area of interest. They do not have to be preoccupied with other classes or extracurricular activities, as is normally the case in the regular public-school setting.

The tech-prep summer program has benefited Luna Vocational Technical Institute and its faculty by allowing them the opportunity to instruct and work with youngsters who might later attend the Institute as postsecondary students. Former summer tech-prep students who enroll in LVTI's associate-degree and certificate programs have already established a good working relationship with the instructors. They appear better adjusted to the college learning environment than first-time students. And academically, these student achieve quite well. The increased viability and the success of the summer program have enabled the Institute to make better recruitment projections for their postsecondary technology programs and to do a better job of preparing students for entry into careers as industrial and technical workers.

Some students have opted to enroll in engineering programs at major universities such as the University of New Mexico and New Mexico State University. Others, of course, will attend out-of-state universities. Many students, however, have indicated plans to enroll in technology or related programs at LVTI or other two-year colleges. One student who participated in the two previous summer programs also took postsecondary courses at the Institute during the regular school year before graduating from high school in May 1990. He has applied all of those credits toward an Associate in Applied Science Degree in Electronics which he will receive in May 1991—one year after completing high school. It is hoped this successful example will encourage other young high-school students to follow closely behind.

In addition to the summer programs, LVTI has also embarked on a successful "concurrent enrollment" scheme with area high schools. This type of enrollment allows high-school juniors and seniors to take classes at LVTI concurrently with their high school class load. As in the summer program, students are able to take the LVTI classes for either secondary or postsecondary credit, or both, depending on what each respective high school approves. By the time these students graduate from high school, college credits they have earned hasten their entry into postsecondary programs at LVTI.

Luna Vocational Technical Institute's efforts at establishing creative forms of partnership with high schools in northeastern New Mexico have resulted in these exemplary programs for high-school students. Much credit is due, of course, to the participating communities and the secondary-school administrators for their cooperation and support of this venture to prepare their high-school students for entry into the realm of postsecondary learning. And LVTI continues to forge ahead in this effort by laying out plans to offer other "summer programs" and regular school-year courses for high-school students interested in technical careers.

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RETRAINING FOR TECHNOLOGY

TPAD for Adults

Anatomy of a Transformation •
Revitalizing the Work Force In Ohio •
A Technology Boot Camp in Texas •

"The Transformations program is similar to a tech-prep program in that it is an excellent way of preparing students with the technical literacy they need to find jobs or continue their technical education. Both programs build specific technical training on a foundation of technical basics and applied-academic skills."

Introduction

Preparing a stronger, more capable work force entails more than educating young people to enter the work force three to five years from now. According to the United States Census Bureau, the number of eighteen- to twenty-year-olds in this country is declining 19 percent, while overall population is increasing 18 percent. This means that by the year 2000 the average age of workers in the United States can be expected to increase from thirty-six to thirty-nine years.

Employers are beginning to realize that they can no longer grow by adding new, young workers as they did in the 1970s, when the baby-boom generation swelled the work force and made hiring a buyer's market. In order to keep their productivity growing, therefore, employers must strengthen the existing work force, drawing on the ranks of those who previously were unemployed or underemployed—minorities, women, previous criminal offenders, and especially displaced workers.

But demographics is not the only phenomenon that is changing the job market. Equally important is the surge of technology that threatens to leave many current workers unemployable. As employers attempt to upgrade the existing work force to rebuild their industries, they are finding that most of their front-line workers have inadequate skills and knowledge for work in today's highly technical fields. Recently, New York Telephone personnel managers were frustrated to find that out of fifty-seven thousand applicants tested, only a few more than two thousand were capable of filling the company's entry-level technical jobs. Those two thousand workers not only had specific training and advanced technical skills, but also a solid academic and technical background. Unfortunately, the almost fifty-five thousand adult workers who were *not* selected were probably those with inadequate or obsolete technical or academic skills. They are unlikely to be able to compete for jobs, even in a market that is desperate for skilled workers.

The solution for these adult workers and their potential employers is not another "quick fix" that emphasizes cheap, easily attainable skills in a narrow field. Such skills will become obsolete as quickly as the new equipment that workers use. Instead, the solution for these adults lies in re-laying their academic foundation and then building new technical skills onto that new and more solid base. Adult TPAD programs offer this kind of ground-up retraining for workers whom the job market is leaving behind.

But rebuilding an academic foundation is not as simple as it sounds. Most of the candidates for adult TPAD programs have a poor educational background, they disliked school as it was presented to them years earlier, and/or they lack the confidence in their ability to reenter school successfully.

At the risk of oversimplifying a complex issue, the future front-line technical workers in this country will likely come from the ranks of people who have a history of academic underachievement, low confidence in their ability to learn, and little motivation to try! Many of these people are fourteen to fifteen years old and are ideal candidates for the secondary/postsecondary TPAD programs discussed throughout this book. But there are also many adults aged twenty-two to fifty-five in a similar plight. The major difference is that most adults have already faced the reality of trying to support themselves—and, in many cases, their dependents—with skills that do not qualify them for well-paying jobs. Thus the motivation of adults to learn technical skills is generally higher than that of most middle- and high-school students.

Based on this rationale, the argument for adult tech-prep programs is as sound as the argument for high-school tech prep. Like the high-school versions, adult tech-prep programs should contain:

- An applied-academic foundation in math, science and communication skills, and
- technical skills, built upon the applied-academic foundation.

The goals of the tech-prep program should be to provide:

- sufficient knowledge and skills to enable student to articulate smoothly into postsecondary programs in advanced technical fields, and
- sufficient employable skills to enable TPAD students to reenter the job market if they cannot continue as full-time students in technical, community, or junior colleges.

An early attempt at such a tech-prep program for adults was made in 1986 in Copperhill, Tennessee. That was the year that Tennessee Chemical Company (TCC) announced they would close their copper mines in 1987. This meant the mine workers faced probable unemployment in twelve to fifteen months.

The Tennessee Valley Authority (TVA) received a grant from the Department of Labor to counsel, retrain, and locate jobs for the soon-to-be-displaced workers. Along with several other options for retraining TCC workers, TVA sought to develop a program using Principles of Technology to provide high-tech skills to workers who chose this program. TVA enlisted the Center for Occupational Research and Development (CORD) to design the curriculum for and assist in the implementation of the program. The plan was for TCC workers to receive retraining prior to layoff, so that, by the time they lost their jobs, these workers would be qualified for new employment opportunities in technical jobs.

CORD designed a four-hundred-hour program that began with a pretech (math skills) course. It went on to include instruction in Principles of Technology, use of personal computers, and technical graphics, plus training in electronics, mechanics, and fluid power systems. A model of the curriculum, called "Transformations: Retraining for Technology," is shown in figure 1.

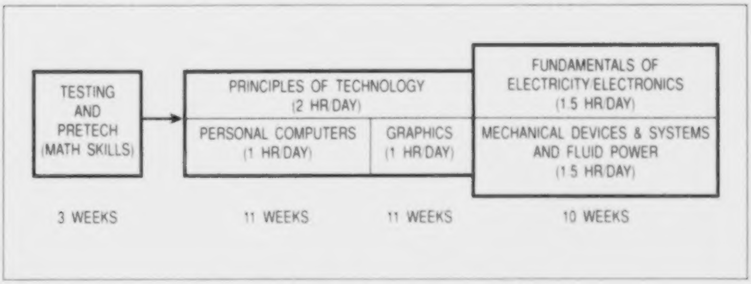
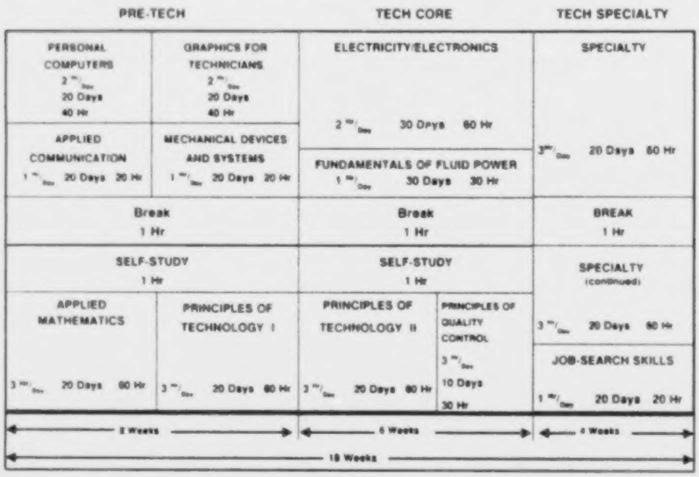

TESTING AND PRETECH (MATH SKILLS)
PRINCIPLES OF TECHNOLOGY (2 HR/DAY)
PERSONAL COMPUTERS (1 HR/DAY)
GRAPHICS (1 HR/DAY)
FUNDAMENTALS OF ELECTRICITY/ELECTRONICS (1.5 HR/DAY)
MECHANICAL DEVICES & SYSTEMS AND FLUID POWER (1.5 HR/DAY)
3 WEEKS
11 WEEKS
11 WEEKS
10 WEEKS

Figure 1: The First Transformations Model

The program was taught for thirty-two weeks, four days per week, for three hours per day. Workers took the courses at on-site laboratories and classrooms before or after completing an eight-hour work shift in the mines. Despite this daunting schedule, forty students enrolled in the first Transformations class. Twenty-six completed the program, and all completers who would relocate were offered jobs at wages ranging from six to seventeen dollars per hour. Subsequent classes were formed with similar success.

Based on the Copperhill Transformations model, the United States Department of Education awarded a grant in 1988 to develop a model demonstration center for retraining displaced workers. CORD revised the curriculum, adding applied-academics courses such as Applied Mathematics and Applied Communication and technical specializations in electronics, quality control, and fluid power systems. The program (as shown in figure 2) was reorganized into a five-hundred-forty-hour curriculum to be delivered six hours per day, five days per week, for eighteen weeks.


PRE-TECH
TECH CORE
TECH SPECIALTY
PERSONAL COMPUTERS 2 Hr/Day 20 Days 40 Hr
GRAPHICS FOR TECHNICIANS 2 Hr/Day 20 Days 40 Hr
ELECTRICITY/ELECTRONICS 2 Hr/Day 30 Days 60 Hr
SPECIALTY 3 Hr/Day 20 Days 60 Hr
APPLIED COMMUNICATION 1 Hr/Day 20 Days 20 Hr
MECHANICAL DEVICES AND SYSTEMS 1 Hr/Day 20 Days 20 Hr
FUNDAMENTALS OF FLUID POWER 1 Hr/Day 30 Days 30 Hr
Break 1 Hr
Break 1 Hr
BREAK 1 Hr
SELF-STUDY 1 Hr
SELF-STUDY 1 Hr
SPECIALTY (continued) 3 Hr/Day 20 Days 60 Hr
APPLIED MATHEMATICS 3 Hr/Day 20 Days 60 Hr
PRINCIPLES OF TECHNOLOGY I 3 Hr/Day 20 Days 60 Hr
PRINCIPLES OF TECHNOLOGY II 3 Hr/Day 20 Days 60 Hr
PRINCIPLES OF QUALITY CONTROL 3 Hr/Day 10 Days 30 Hr
JOB-SEARCH SKILLS 1 Hr/Day 20 Days 20 Hr
8 Weeks
6 Weeks
4 Weeks
18 Weeks

Pretech
The first phase provides workers some of the basic skills needed in technical employment. Pretech includes refresher courses in math and communication, an introduction to the use of personal computers, a basic understanding of drawings commonly used in technical fields, fundamental knowledge and skills in working with mechanical devices, and a background in physics—mechanical, fluid, electrical, and thermal—that is needed and applied by technicians.

Tech Core
This phase develops the students' knowledge and skills that are used in a variety of technical occupations. This segment includes hands-on course work in the areas of electricity/electronics, fluid power, and quality control/statistical process control.

Tech Specialty
During the Tech Specialty phase of the Transformations program, students develop specialized skills by focusing on a specific area of technology. Through technical specialization courses such as CNC Machining, QA/QC (SPC), Electronic Systems, Plastic Injection Molding, Metal Blanking, and Industrial Chemistry. Skills learned in Tech Specialty make students more adaptable and marketable within their chosen fields.

Figure 2: The Transformations Program as Tested at Lorain County Community College

The resulting program, first tested at Lorain County Community College in Elyria, Ohio, has processed eighty-five completers in four consecutive sessions. Nearly all the completers either have been placed in jobs or have articulated into associate-degree programs at LCCC.

The Transformations curriculum was adapted by Texas State Technical Institute in 1989 to retrain displaced workers under United States Department of Labor JTPA funding. In the first four classes of students, nearly half of the completers elected to continue their studies at TSTI and earn Associate of Applied Science degrees in an engineering technology. Thus the TPAD concept has been extended for adults by articulating the Transformations curriculum into an associate-degree program. Postsecondary credit for the Transformations courses is being awarded for continuing students at both LCCC and TSTI.

Similar Transformations programs are being conducted or planned in at least twenty-five other locations throughout the United States, including Saginaw, Michigan, and Hagerstown, Maryland. Note that the Transformations curriculum is very similar in content to the high-school portion of the TPAD curriculum shown in chapter 3.

This chapter will begin by discussing the structure, organization, and characteristics that make up a Transformations program. The details of the Transformations programs at Lorain County Community College and Texas State Technical Institute will follow.

Anatomy of a Transformation

Walt Edling and Alan Sosbe

Workers displaced by applications of technology lose their jobs because their knowledge and skills are limited to specific manipulation of devices, with little or no comprehension of underlying principles. The Transformations retraining program provides dislocated, technologically illiterate workers with the basic knowledge to function in entry-level industrial positions. It is also intended to guard against future displacement by providing a solid base for ongoing technical training.

PROGRAM CONTENT

The Transformations program shown in figure 2 outlines the program content, which progresses smoothly from basic concept to specific applications. It is convenient to view this curriculum in three major phases: pretechnical, technical core, and technical specialty. The content of the technical specialty may be varied to accommodate local needs, which are established through use of an advisory committee made up of local employers. As changes in the specialty are made, the pretechnical and technical core areas my be adjusted accordingly.

The content of the pretechnical and technical core courses is as follows:

1. *Personal Computers* introduces students to computer terminology and the use of software. Students learn elementary skills for software installation and gain an understanding for working with menu-driven software.

2. *Applied Communication* helps students develop improved reading, writing, listening, speaking, problem-solving, visual, and nonverbal skills.

3. *Applied Mathematics* relates math and technology topics to specific applications, many of which can be demonstrated or experienced by students through tangible exercises.

4. *Technical Graphics* teaches students how to develop and interpret technical sketches and covers the use of line-types, multiview drawings, dimensioning, and tolerance practices. The course also includes an introduction to computer-aided drafting and its applications.

5. *Mechanical Devices* familiarizes students with different types of drive mechanisms such as belts, chains, and gears, and types of actuators such as mechanical linkages and cams.

6. *Principles of Technology* shows the relationships between concepts in mechanical, fluid, electrical, and thermal energy systems which are commonly encountered in industrial environments. In this applied form, concepts of physics are taught to students who otherwise might have difficulty understanding them.

7. *Electricity/Electronics* covers the concepts of voltage, current, resistance, Ohm's law, series and parallel circuits, capacitance, inductance, and the basic operation of solid-state devices. Hands-on labs include instruction in the use of volt-ohm-milliamp meters, oscilloscopes, signal generators, and other equipment. AC and DC circuits are assembled and tested.

8. *Fluid Power Systems* covers common hydraulic and pneumatic systems, pumps, control valves, pressure-control devices, flow regulators, cylinders, and motors. Hands-on labs emphasize the use of test devices such as pressure gauges and flowmeters to diagnose system faults.

9. *Principles of Quality Control* is an inspection methods course. Hands-on labs provide practice in the use of all common inspection instruments. Statistical-process control techniques are presented and applied to workplace examples.

PROGRAM ORGANIZATION AND DELIVERY

The Transformations program content is designed to provide participants with essential information that is useful in a variety of employment situations. However, the manner in which the program is operated and delivered to the students is equally as important as the content. The success of the Transformations curriculum with people who had performed poorly in their previous educational experiences seems to indicate that attention to factors beyond content enhances the program's effectiveness significantly.

In 1989, the Transformations curriculum was pilot tested at Lorain County Community College with four groups of twenty-five people. Most of the participants in these pilot programs had a high incidence of negative educational experience from the past. Most had been average or below-average performers in traditional classrooms and consequently had developed an expectation of failure. In the Transformations programs, however, these people had an overall retention rate of 85 percent. Placement now approaches 100 percent.

The Transformations program is designed to address the needs of participants in ways that maximize effectiveness and enhance the ability of the participants to apply the content in a job setting. Program characteristics addressing this goal include:

1. *Hands-on learning*. In the Transformations program, the goal is to relate every concept to specific applications that can be physically experienced. Hands-on application of concepts is accomplished simultaneously or within a very short time following the explanation of those concepts in a classroom setting. Focus on applications enhances the relevance of topics, thereby developing a higher level of student interest and motivation.

2. *Applications orientation.* Although participants were not tested on their learning or cognitive styles, it is evident by observation that Transformations participants respond positively to concrete, active, and participative forms of learning. While students who are strong in the logical and abstract forms of intelligence are able to deal with temporal and spatial separation between theory and application, the

majority of learners are better served by immediate reinforcement through tactical, visual, auditory, and kinesthetic reinforcement.[1]

Application of the technical principle being studied results in better understanding and retention of that principle.

3. *Team learning (cooperative learning).* Various exercises used in the training require students to work in teams or in small groups. Sharing information and assisting one another are openly discouraged in most traditional classroom settings, but are encouraged in the Transformations program. The benefits of this approach are many. The students learn from one another, assist one another in clarifying areas of confusion, and develop the skills needed to work together in groups or teams. Studies of industry needs and reactions from advisory groups and industry supervisors indicate that lack of these skills is one of the great weaknesses of the American work force. In fact, many of the skills and abilities valued in traditional educational settings do not appear to coincide with those skills valued by employers.[2]

Cooperative or team learning can be effective even when the participants do not understood the material at the beginning of the process. In fact, learning that results from joint discovery of new information may be far more effective than that acquired through conventional means. In addition, most older workers have areas of expertise of which they are not fully aware. Being able to share that information increases their confidence and sense of self-worth. For this reason, efforts were made in the pilot programs to provide opportunities for each participant to share personal knowledge or experience with others in the group.

4. *Encouragement of cooperation rather than competition.* Traditional educational experiences tend to be individualistic (don't help or ask for help from your neighbor) or even competitive (grading on the curve). Too often the focus is on sorting students into successful or failing categories. Cooperative learning methods, on the other hand, facilitate individual participation and accountability while helping participants develop the ability to work together. Concepts of

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1. Ronald R. Schmeck, *Learning Strategies and Learning Styles* (New York: Plenum Press), 1988 and Corinne O'Connor Cody, "Learning Styles including Hemispheric Dominance-A Comparative Study of Average, Gifted and Highly Gifted Students in Grade 5" (Ph.D. diss. University of Michigan, 1983).

2. Paul E. Baron, *Skills Employers Need—Time to Measure Them?* (Princeton, NJ: Policy Information Center, Educational Testing Center, 1990).

cooperative learning have been explored in depth by Johnson and Johnson, and the skills and awareness required of instructors and students have been defined.[3] Since most instructors are not familiar with the needed techniques, an inservice program for teachers is usually essential if benefits of cooperative learning are to be fully realized.

5. *Allowance for differences learning styles and rates.* An environment of mutual support among the participants was strongly encouraged, and a goal of success for all participants was established early and reinforced on a regular basis. As individuals encountered difficulty or began to fall behind, others in the group were enlisted to encourage and assist them. Extra assistance or tutoring was available on short notice to all participants and was represented as a normal and natural part of the process for everyone. The concept of failure or inadequate performance was shunned both overtly and covertly, and grades were not used. The focus was on assisting everyone to move toward reasonable goals with little issue made of variations in the time or effort required to achieve those goals.

6. *Consideration of personal issues affecting students.* The pilot programs focused considerable attention on the emotional and interpersonal needs of the students. Whenever it appeared that anger or frustration was beginning to affect students, interactive focus and ventilation groups were used to provide for processing and diffusing tensions. Not only was individual counseling assistance readily available, but personal and family problems were also recognized as affecting the educational experience and were addressed openly.

The extensive involvement of group interaction (seven hours a day for a period of eighteen weeks) resulted in many friendships and other forms of mutual support among the students. When they were provided with the opportunities for conflict resolution and stress relief, the groups developed a strong rapport and high degree of mutual support. Unlike traditional classrooms, where students may feel alone and in competition with others in the class, members of these groups built a network of support to assist one another in the program.

A side benefit of the overall approach taken by the Transformations programs was improved communication skills for the students.

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[3] D. W. Johnson and R. Johnson, *Learning Together and Alone: Cooperative and Individualistic Learning*, 2nd ed. (Englewood Cliffs, NJ: Prentice-Hall, 1987).

Communication is a difficult area to teach and to learn, since it involves higher-order thinking and analytical skills. But cooperative learning, focus groups, and interchange of personal knowledge all involve practice in effective communication. Through Transformations, therefore, the participants were provided opportunities to practice communication in meaningful ways that could be reinforced by celebrating and rewarding individual contributions.

A MEASURE OF SUCCESS

The pilot offerings of the Transformations program were evaluated by monitoring their successes in:

- attracting and enrolling students from suitable populations,
- retaining participants through completion, and
- placing them in jobs.

While the primary purpose of the program was job placement, enrollment in further education was also considered to be a positive outcome for participants. In addition, subjective factors such as:

- the satisfaction level of the students,
- student opinions about the program,
- the satisfaction level of employers, and
- employer viewpoints regarding the content of the program

were examined. An independent evaluator was employed to validate the results.

Student Response

When the program was initiated, there was concern that a sufficient number of participants would be difficult to attract. These fears proved to be unfounded; in fact, more students responded than could be accommodated in the program. An initial article describing the program attracted more than one hundred applicants; and additional recruiting carried out through contacts with community-based organizations, local government agencies, and state placement bureaus yielded many more applicants. Figure 3 contains information about the participants in the initial pilot program. That program's success in attracting participants has been replicated in later offerings of the program and in other locations.

TARGET AUDIENCE

- Displaced workers who have exhausted their unemployment-compensation benefits
- Workers at risk of layoff or dislocation due to anticipated business/plant downsizing
- Workers who are significantly underemployed
- Displaced workers who desire to enter the technical work force

BACKGROUND

- Reading ability no lower than eighth-grade level; required to pass Nelson-Denny Reading Test, Forms C and D, at a satisfactory level
- Mathematics ability that includes a facility with common arithmetic operations; required to pass Tests of Basic Education (TABE) at a satisfactory level
- Interest in understanding *how* and *why* technical devices and systems operate

CHARACTERISTICS OF A TYPICAL CLASS

- Range in age from early 20s to early 60s; 50% are in the 30 to 39-year range
- Male-female split is 80-20
- One-third come from traditionally underrepresented groups
- The few who have not completed high school have completed GED requirements
- A few have associate or baccalaureate degrees
- Many have participated previously in employer-sponsored training programs

Figure 3: Participant Characteristics

The strong student response to the pilot programs appears to be a reaction to the potential for reemployment within a short time. The applicants were anxious to return to work and felt that the training provided in the Transformations program offered that promise. They were able to find ways to survive financially for the eighteen weeks the curriculum required, whereas they did not feel able to attend conventional classes for longer periods of time.

Retention in the pilot program was exceptionally high. Typically twenty-one to twenty-two students completed the program from an initial starting group of twenty-five. When asked about their reasons for sticking with the program, participants cited many of the program characteristics described above, with attention to individual needs and interpersonal issues surfacing most frequently. Participants felt that personal attention from faculty and program managers addressed student problems before the problems grew big enough to cause the student to drop out.

Student reactions have been solicited throughout the program and following the program. The level of satisfaction has been extremely high in regard to content and program delivery. It is interesting to note that student reactions focused most heavily on program delivery, and many of them are very emphatic about identifying these issues. Figure 4 contains comments offered by some of the graduates of the first pilot group in an informal debriefing session. These students had already entered employment and were very enthusiastic and open in their comments.

The students' choice of words is revealing and bears careful reading. These are comments from mature, pleasant adults and were offered with serious conviction. Examples such as "anger and frustration," "made to feel stupid," and "threatening and overwhelming" reveal emotional scars from earlier educational experiences.

- A "safe" environment existed for participants. We were "spoon fed" early in the program in computers and math which built confidence. We were never made to feel stupid. [Classes and instructors] were not threatening or overwhelming.
- Goals of the program were realistic and achievable by all of the students. Faster students were given additional problems. Additional support was available whenever needed for those who had difficulty.
- Student [self] confidence increased through success in learning, atmosphere of positive reinforcement, new friendships, mutual support among students, extensive involvement with groups [seven hours per day for eighteen weeks].
- The use of focus groups is important for interaction, to ventilate need, to deal with anger and frustration based on past experience [former educational experience].
- There was no competition among students; rather students supported each other. Each person's strengths were recognized and utilized. The variety in student background was very valuable.

Figure 4: Summary of Student Comments After Completing the Pilot Program

Employer Response

Discussions with various employers and advisory committees have validated the content of the Transformations program. Every employer who has looked closely at the content has reacted favorably and has felt that the content was appropriate.

Employer response to program graduates has been positive as well. Job placement for the Transformations students has been extremely successful in the pilot program. The initial group achieved 100-percent placement, and subsequent groups are expected to exceed 95-percent placement within the near future. At this time, overall placement in the pilot program has passed the 96-percent level.

Graduates of the program appear to be working out well in their new positions, and the employers state that the graduates are better prepared than traditional job applicants. Long-term follow-up studies will be pursued to identify any possible weaknesses in the program.

FACULTY CONSIDERATIONS

Instructors in the first pilot program were adjunct faculty who were currently or recently employed in industry. Partly because of the concentrated structure of the program and partly because of the commitment of the teaching staff, students had ready access to the instructors whenever needed. Many students commented about the opportunity to talk with teachers and drew pointed comparisons between their experiences in the Transformations program and prior educational experiences.

Whether their perception is factual or not, students in the pilot programs felt that instructors traditionally are difficult to find and approach with questions. This view is undoubtedly exacerbated by the fact that many of the students had unsatisfactory educational experiences in the past and tended to develop negative rather than positive relationships with instructors. Comments from subsequent participants follow a similar pattern. Where instructor support is perceived as being weaker, participants immediately began to feel overwhelmed by the pace of the program, and dropout rates show a definite increase.

The need for close coordination among instructors to provide integrated hands-on curriculum is very important to Transformations programs. This can cause difficulties for professional teachers who are hired to teach in these programs. Many experienced instructors are committed to certain patterns of instruction and are unaccustomed to working closely together. They often require extensive orientation to the Transformations approach. This may be one reason that the programs taught by adjunct faculty from industry have proved so successful. Instructors who are currently employed in business may be more willing than professional teachers to accept advice as a condition of the job and therefore more adaptable to the Transformations approach.

POSSIBLE CONCERNS ABOUT TRANSFORMATIONS PROGRAMS

While the concentrated time frame of this training curriculum is very useful in moving participants rapidly toward the job market, it can also be a disadvantage. Most students find the pace very intense; it could easily become overwhelming or discouraging. The intense pace makes it extremely important that individualized tutoring, counseling, and interpersonal support be provided on a regular and timely basis.

Since the program is nontraditional in many respects, it is viewed with suspicion by the conventional educational community. Effort must be expended to show the value of the program and to build support and cooperation within the educational institution. While it is possible to operate the program without such a base of support, program graduates who later seek to continue their education through traditional channels may run into difficulty. Transfers, advanced placement, or credit for work accomplished in the Transformations program may be difficult to obtain. It is worth the effort, therefore, to confront and negotiate these issues early in the program.

For students who aspire to a degree or for employers who may want their employees to pursue a degree program, the issue of credit for the Transformations program is especially important. While the first pilot program was operated without degree credit, it now appears that half of the content will be eligible for credit. Since awarding of credit may likely reintroduce the concept of grades (and therefore competition), care will need to be exercised to avoid the pitfalls of competitive education.

Evaluation of the Transformations program should be done not only through the students and instructors, but also by continuous reviews from the advisory committee. It is important that employers and other members of the committee continue to evaluate the relevance of program content to the requirements of the industry. A firm foundation of local support and employer commitment are essential to the success of any adult TPAD program, and program developers should pay careful attention to obtaining and maintaining this support.

Revitalizing the Work Force In Ohio

Sandra Everett

The establishment of the Transformations Program at Lorain County Community College (LCCC) in Elyria, Ohio, was the result of several years of critical unemployment problems in the area. During the middle to late 1980s, this single county experienced more than seventy-five plant closings or relocations and faced a General Motors plant closing that ultimately displaced two thousand people. Unemployment at one time reached 25 percent. Most of these displaced workers had been unemployed in Lorain County for as long as three months, six months, eight months, or even a year by the time the United States Department of Education granted the funds to pilot test a model demonstration program at LCCC.

LCCC was an ideal place to begin the Transformations program. At the time, General Motors and the United Auto Workers were housing a transition center for relocation of displaced workers on the LCCC campus. The transition center became an excellent resource for recruiting displaced workers in the region to enter the Transformations program.

Representatives from eight local employers and unions made up the Transformations advisory committee:

- General Motors (representing the automotive industry),
- Invacare (medical),
- Teledyne Republic (aerospace),
- Stanadyne (Moen faucet),
- Rolen Plastics (plastics),
- Ross Corporation (environmental),
- the local International Brothers of Electrical Workers union (AFL-CIO), and
- the local Pipefitters union (AFL-CIO).

It was important for the advisory committee to represent several different areas of industry. In order for Transformations to continue to make a long-term effect on the community, the committee had to recognize the needs of every local industry, instead of the needs of the largest companies.

Members of the advisory committee were asked to determine the technical specialty areas that should be added to the pretechnical and technical core classes, basing their decisions on specific hiring needs in the community. The members agreed on these specialties:

- CNC Machining, which focuses on the fundamentals of computer numerical control setup and operation.
- Electrical/Electronics, which provides a continuation of the Electricity/Electronics study in the technical-core section of the program.
- QA/QC (SPC), which explores inspection methods and the relationship of quality-control production, inspection, and engineering.
- Plastics, Injection moulding (designed and offered for last two classes)

From the very beginning, the Transformations program at LCCC placed a major focus on job placement. Job-search skills were taught, and career counseling was an integral part of the program. Before, during, and after the program implementation, local employers were contacted and encouraged to hire students completing the Transformations program.

The employer response was clearly positive and encouraging, since the job placement for these students has now reached 96 percent. In addition, some employers outside of Lorain County have discovered the quality of students the program produces. The O'Sullivan Corporation, for instance, gives hiring preference to anyone going through the Transformations program, and has a policy of interviewing all Transformations students. This sort of employer incentive provides motivation and encouragement for students who begin the program with their self-confidence at its lowest ebb.

Tech-prep programs have proved very successful in preparing high-school student for postsecondary technical education and industrial careers. The Transformations model at Lorain County Community College is similar in concept, although the focus is on the "adult learner" and the emphasis is on quick job placement. While industry is willing to provide specialized training for new equipment and systems, they do not have time to assume the burden of teaching basic technical skills and competencies, which more and more applicants lack. Transformations is viewed as an approach to providing dislocated workers with the basic skills and competencies they need to reenter the work force and the ability to continue to learn industry-specific requirements.

A Technology Boot Camp In Texas

Steve Malbrough

During the 1980s, many businesses and industries in the area around Waco, Texas, were dramatically affected by a number of events, including:

- an economic recession following a slump in oil prices,
- offshore competition,
- plant closings, and
- escalating technological change.

Consequently, many Central Texas workers were dislocated with limited options for future employment. In response, the Heart of Texas Council of Governments (HOTCOG) provided the resources for Texas State Technical Institute (TSTI) to start a new program that would provide these workers with technical education and retraining.

HOTCOG and TSTI worked with the Center for Occupational Research and Development to pull together an advisory committee made up of representatives from a number of local employers, including:

- Hillcrest Baptist Medical Center,
- Marathon Power Technologies,
- Lone Star Gas Company,
- Elsinore Airframe Services,
- Hercules Aerospace Company,
- Central Texas Iron Works,
- Plantation Foods,
- Waco Systems,
- Weyerhaeuser Company,
- M&M/Mars,
- Mercury Tool and Machine,

- Allergan, and
- Electrospace Systems.

These members agreed that the goal of the TSTI Transformations program (jokingly referred to as Technology Boot Camp) should be to provide adult workers with the basic academic skills and technical knowledge they need to reenter the job market or seek further education. In other words, Transformations at TSTI would provide a broad base of technical literacy to which specific technical skills could be added.

After evaluating the job market, the local economy, and the recommendations from the local advisory committee, project developers determined that the local employers most needed workers trained in quality control and chemical technology. These areas, therefore, would serve as the technical specialties for the Transformations program. After the initial two cycles of the project, however, TSTI moved away from offering any specialty areas.

The advisory committee felt that, rather than providing job skills in a specific technology, Transformations should focus on providing basic academic and technical skills. The retrained adult who goes to work immediately after completing such a program tends to be flexible and adaptable, capable of undertaking different jobs within the company or plant without extensive training. And Transformations completers who opt for continued learning will have a solid foundation on which to build a technical specialty.

Texas State Technical Institute benefits from its Transformations programs because the instructors in the forty-five program areas receive a better-prepared student. Transformations graduates tend to be further advanced than other students in science and mathematics, have better study skills, and understand technology better. They can adapt to differences in curriculum formats; they are highly motivated; and they take initiative in the teaching-learning process. In fact, Transformations graduates often prove to be a challenge to their teachers, who are unprepared for how quickly these students are able to learn and to integrate their knowledge into marketable job skills.

The intensity of the Transformations curriculum and the method of delivery provide both the major benefit and the reason for success of this program (see figure 5). Students are in class from eight in the morning until five in the evening, five days a week, for eighteen weeks. This concentrated method of delivery tends to restructure the students' learning habits. Peer support is encouraged, and students team up and approach problems as a group. The accessibility of open labs and the availability of computers for each student have helped give students:

- motivation and an understanding of the need for good study habits;
- an understanding of how teamwork is achieved and how it improves productivity;
- problem-solving and critical-thinking skills;
- facility in using computers for instruction, problem solving, and homework assignments; and
- ability to work independently and research information rather than just regurgitating what is taught in class.

Transformations is similar to a tech-prep program in that it is an excellent way of preparing students with the technical literacy they need to find jobs or continue their technical education. Both programs build specific technical training on a foundation of technical basics and applied-academic skills. Transformations and tech prep are alike in that both prepare students for meaningful and fulfilling work in the marketplace of today—and tomorrow.

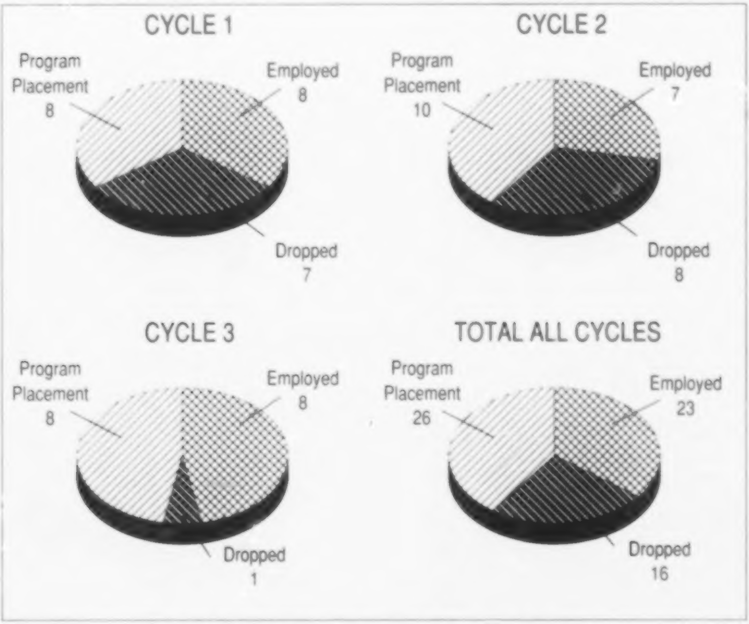


Figure 5: Student Outcomes of the First Three Cycles

8

GETTING 'EM AND KEEPING 'EM

Recruiting and Retaining TPAD Students

- **Promoting TPAD**
- **Using Video And Other Media for Promotion**
- **Computerizing Your Articulation Efforts**
- **Using Counselor Handbooks And Student Guides to Promote TPAD and Counsel Effectively**

"A TPAD program may have a well-designed and well-taught curriculum, but not have enough students to maintain the courses. Good promotional and recruitment activities, along with excellent counseling and support services, are required to have a successful program."

Introduction

A well-designed,educational program without students is like a beautifully crafted automobile without wheels, both may look good, but neither one will go anywhere.

Similarly, for a TPAD program to be successful, students must enroll in and complete the course of study. And this requires effective promotional and recruitment activities, along with excellent counseling and support services.

The selections in this chapter focus on promotional and counseling activities necessary for attracting students to TPAD and retaining them in the program. Several themes reoccur in these selections:

1. *The importance of clearly defined, but flexible, career goals for students.* Opportunities must be provided for exploration and for changing goals as interests and capabilities change.

2. *The importance of clearly defined courses of study. that provide students with the opportunity to prepare for various career goals.* The courses of study in the tech-prep programs should be as clear and as comprehensive as the courses of study in the college-prep programs. All courses of study should have high expectations for students and allow opportunities for students to transfer from one course of study to another.

3. *The need for an understanding and appreciation of the newly emerging midlevel technical careers among all segments of the community.* This means teachers, counselors, administrators, students, parents, employers and the general public.

4. *The need to provide systematic and ongoing counseling and support services for all students as appropriate to their interests and abilities.* The kind of systematic guidance usually provided to college-prep students should be available for all students. Teachers in all subject areas and members of the employer community should be involved in supporting the students as well as the school counselors. Parents and students should also be empowered to assist themselves.

5. *The need to develop comprehensive and systematic promotional (marketing) programs and support materials.* These should target the various populations—teachers, counselors, administrators, students, parents, and general public.

SPREADING THE WORD ABOUT TPAD

As previous chapters have clearly indicated, few people understand the advantages of TPAD programs for students, schools, employers, and society in general. For this reason, extensive promotional campaigns may be necessary to spread the word about this educational/vocational option. But promotion will not be effective if it consists of uncoordinated, spasmodic, "one-shot" efforts. Promoting TPAD must be a well-thought-out, coordinated, comprehensive, long-term effort.

A comprehensive promotional plan will recognize and focus on several different populations: educators, students and parents, the business community, and the general public. Some general information and materials may be appropriate across all populations. However, the special interests and motivations of each population will need to be taken into consideration. Selections in this chapter provide ideas for designing, developing, and implementing promotional campaigns, as well as developing and effectively utilizing various promotional materials and activities such as written materials, special activities, and video.

PROVIDING GUIDANCE AND SUPPORT FOR STUDENTS

Previous chapters have also shown that TPAD provides a promising education and vocational alternative for students who are either uninterested in pursuing or unable to pursue a baccalaureate degree. However, comprehensive promotional and counseling programs are necessary to inform students and parents about TPAD and convince them of its value. Counseling programs also are needed to assist students in understanding their interests and abilities, choosing compatible career goals, and enrolling in appropriate courses of study for achieving those goals.

Stated another way, several conditions are necessary in order for students to choose realistic career goals.

- Students need to be aware of their own interests and abilities.
- Students need to be aware of career options that match their interests and abilities.
- Students need to have opportunities to explore various career options.
- The educational system, parents, and the general public must be aware of and place value on the various career options.
- Courses of study that allow students to prepare for various career options need to be clearly defined and understood.

Promotional and counseling programs must create these conditions for all students. The materials in this chapter provide assistance in developing such programs.

Counseling and support are not the exclusive responsibility of counselors. Career awareness needs to be integrated into school curricula from the elementary level up, with special emphasis in junior-high/middle school and the first two years of high school. These activities require the involvement of all teachers and administrators, as well as selected employer representatives.

Counselors, however, do have the specific responsibility for helping students assess their interests and abilities, guiding them in exploring and selecting career goals, and advising them about appropriate courses of study for achieving their career goals. Special counseling materials and resources can help counselors do their job. Selections in this chapter give special attention to how TPAD guidebooks and a computerized database can assist in the process of guiding students, supporting them in their courses of study, and developing courses and programs.

Promoting TPAD

Judy Marmaras

Successfully promoting a TPAD program is an ongoing, multiphased process. It is also multifaceted, involving such varied activities as developing written and visual materials, making personal presentations and holding meetings, planning and coordinating student activities, and maintaining press contacts.

Such a complex and important activity cannot be left to chance. Marketing thus requires a written strategy—a formal plan designed to increase program awareness and stimulate interest. An effective marketing plan should:

- lay down measurable objectives,
- identify and address the needs of different audiences,
- present information clearly, and
- answer any questions individuals might have about the program.

This plan should ideally be developed by the Information/Promotion Committee, which should include at least one or two persons with marketing or public-relations experience. Access to professionals in the employment community or the public-relations staff of the postsecondary institution can also be invaluable to public-relations efforts.

DEVELOPING A PUBLIC-RELATIONS CAMPAIGN

When a marketing plan was developed , two approaches were considered:

- a public-relations campaign whereby TPAD program staff are directly involved in a number of promotional activities, or

- a paid advertising campaign.

There are advantages to both approaches, and the choice of approach depends on individual circumstances. However, TPAD developers at the Community College of Rhode Island found that paid advertising campaigns were both expensive to conduct and relatively ineffective in reaching students. For instance, newspaper advertisements and other forms of mass communication were ineffective in reaching the target audience. In 1987, therefore, the college adopted a staff-run public-relations campaign to promote the 2+2 Tech Prep/Associate Degree program in Rhode Island. Such a public-relations campaign can be developed with a limited budget and can incorporate both written materials and personal presentations to effectively promote the TPAD concept and program.

DEVELOPING BROCHURES AND OTHER PRINTED MATERIALS

Written materials such as brochures, flyers, newsletters, press releases, and college publications can be invaluable for disseminating program information to a wide and varied audience. It is important, particularly when working with a limited budget, to develop these materials in a way that creates a visual identity for the TPAD program. This can be done by coordinating color and design throughout all printed materials. Because the materials will be distributed to a variety of target groups, the design should be flexible and attractive to young people as well as adults.

All written materials should include the names of the sponsoring institutions to demonstrate their support; at the same time, the materials should clearly state the independent identity of the TPAD program. Working with public-relations staffs of the community colleges or other institutions involved will ensure a professional quality to all promotional materials.

An attractive, well-written brochure is a cornerstone of program promotion and is often an individual's first introduction to the program. Because the TPAD marketing plan must address a highly diverse audience, more than one brochure will be needed—the number of brochures will be determined by the number of distinct audiences (educators, students, parents, employers, etc.) that have been identified.

The text for each brochure should be selected on the basis of who the audience is and what information they will need. For example, secondary-school educators will need to know why they should offer a TPAD program, how the program will work, how it will be implemented, and what the role of the postsecondary institution will be. Employers need to know how a TPAD program will meet their need for more highly skilled workers and how they can contribute to the program. Students and parents need information on what courses students will take in high school, how these courses differ from those currently offered, and how the students will benefit from enrolling in a TPAD program. They also want information on program activities and services, the associate-degree programs connected with the tech-prep program, and job opportunities in technical fields.

Although the brochures will vary in content, all should contain certain general program information. All should contain answers to the following questions, preferably in a straightforward question-and-answer format:

- What is a TPAD program?
- Who is the program for?
- Why is the TPAD program important?
- Who is the person to contact for further information?

Another publication that has proven to be very effective as a handout for students is the flyer, a simple one-page publication which summarizes program information. Because flyers are very inexpensive to produce, large numbers can be circulated at a low cost.

Newsletters provide a more direct promotional approach, relaying current program information on a regular basis. A newsletter should address a varied audience, both students and adults. Program updates, curriculum information, program activities, staff-development workshops, and personal interviews with faculty and students are suitable topics for a newsletter. Pictures should accompany text wherever possible to add interest and personalize the material. Although producing a newsletter is somewhat costly and time consuming, it is an excellent way to provide ongoing information about a TPAD program to a wide audience.

Naturally, information about the TPAD program should be included in existing publications: college catalogs, course bulletins, brochures, and in-house newsletters. Use of these resources establishes the program as part of the existing institutions. This not only increases program visibility, but also strengthens internal public relations—an important and sometimes difficult achievement.

Finally, incorporating the TPAD logo or design on all letterhead, business cards, and student folders will complete a professional package of written and visual materials.

The local press can be another useful resource in communities where high schools are involved in the TPAD program. Issuing press releases on TPAD-related events is a cost-effective way to obtain program coverage and to reach a large audience. In fact, it is a good idea to develop a regular routine of submitting press releases to local newspapers so that every aspect of the program that affects the outside community is covered.

A press release should include the date, place, and time of the reported event, along with a brief description of the TPAD program and a more detailed description of the specific event. Also desirable are a list of participating schools, a list of the students involved in the activity, and pictures with cutlines that identify both the students and their schools.

MAKING PRESENTATIONS

Informative, professionally prepared written materials are essential to a marketing plan; however, simply having information readily available is not enough. Personal presentations by a visible and available TPAD staff not only afford an opportunity to market the program on a personal level to members of the target audiences; they also help promote a cooperative relationship between the institutions involved and allow for the ongoing communication that is critical to the program's success. Conferences and presentations for administrators, teachers, students, and parents are all part of an effective marketing strategy.

The most effective and productive way to introduce a new TPAD program to a large and varied constituency is to schedule at least one awareness conference. These conferences provide an opportunity to present information about the TPAD program, to determine what interest exists among school administrators, and to generate a list of potential schools that might participate in a TPAD partnership. Those invited might include school superintendents, appropriate governing bodies, members of local school committees, legislators, commissioners of education, and other personnel from the state or regional departments of education, as well as high-school principals, counselors, and teachers.

The agenda for an awareness conference should include an introduction to and overview of the TPAD concept as well as a demonstration of the economic and educational need for the program itself (with examples of successful programs in other states or regions). Information on applied-academics curricula could also be supplied. The audience will also be interested in certain general program information, such as startup costs and a time frame for implementation. *The High School/Community College Connection*, a video featuring Dale Parnell, provides an excellent introduction to TPAD programs. Other videos, transparencies, and handouts might also be included in the presentation.

A successful TPAD marketing plan would also involve a number of personal visits and presentations by college personnel to each participating high school. It is important that information about the program be provided at each high school to several different groups including administrators, teachers and counselors, and students and parents. Only through personal visits and presentations can rapport be established and maintained between the college and high school.

Promoting TPAD to a high school usually begins with an information meeting with the high-school principal and the person(s) who initiated the inquiry about the program. Additional presentations can be made to faculty, guidance counselors, students, and parents.

At each presentation for educators and administrators, packets of promotional materials should be available for everyone in attendance. These packets would contain the following:

- program brochures,
- curriculum outlines,
- information on startup costs and possible funding,
- lists of proposed equipment purchases, lab renovations, and other changes that will be required,
- information on staff-development opportunities, and
- a suggested procedure for implementing the program.

Although student recruitment is usually conducted by the high-school staff, a presentation to the students by a TPAD staff member from the college is an excellent way to promote interest in the program. Such a presentation helps establish the role of the college, enabling the students to identify themselves with the program and the program staff. Because high-school students respond better in small groups, it is more effective to make several small presentations instead of one large one.

Presentations to students should provide a description of the courses they will need to complete in high school in order to move into the associate-degree program. Students should also be told:

- why these courses are important,
- how they differ from the courses currently being offered,
- why postsecondary education is vital in today's economy,
- what technical programs are available at the community college, and
- what job opportunities exist in technical fields.

It is important that students see their participation in the TPAD program as a special opportunity that can provide them with a number of educational and career options upon graduation.

Whenever possible, it is also very helpful to address parents and provide them with firsthand information about the TPAD program. Parent meetings should be scheduled in the evening at the high school; employers can also arrange meetings at the workplace for their employees who are parents. Parents need to know:

- how the program will operate at the high school,
- what courses are involved, and
- what opportunities will be available for students when they complete the program.

Experience has shown that parents can be very supportive of TPAD and can be influential in their child's decision to enroll in the program; thus parents can make significant contributions to the success of a TPAD program.

SCHEDULING STUDENT VISITS AND OPEN HOUSES

Promoting TPAD to students requires an aggressive, imaginative plan. One successful approach to program promotion in Rhode Island has been to schedule high-school visits to participating colleges throughout the school year. General tours, orientations, and other activities for high-school students and teachers provide a firsthand look at the technical programs into which the tech-prep programs will feed. These visits also provide college faculty with an opportunity to meet and talk with students and their teachers about job opportunities in technical fields.

Preparing for student visits to the college requires a well-thought-out, organized plan. A first step is to determine the desired outcome of each visit and the best time to hold the activity. Scheduling should take into consideration the high school's calendar and the availability of space and staff at the college. Scheduling the same activities at the same time each year enables the college faculty and the high-school teachers to anticipate and plan for each event.

The college faculty and staff need to be clearly informed of:

- the date of each student visit,
- the purpose of the visit,
- the number of students attending, and
- what is expected of the college representatives.

High schools need to be provided with:

- an agenda for the day of the visit,
- information on the availability of transportation and refreshments,
- an explanation of what type of student should be invited, and
- the purpose of the visit.

Ample space should be reserved on the campus so that college representatives can meet with students and high-school teachers in a large group setting. They should also be given the opportunity to visit and work in the technical labs.

Because it is important to have as much assistance as possible, the college staff should be recruited to assist with guided tours and other activities. This is particularly necessary if large numbers of students attend at one time. TPAD students enrolled at the college are also an excellent resource for high-school visits.

The visit should include some activities that provide entertainment as well as enrichment. The TPAD program at the Community College of Rhode Island schedules a 2+2 cookout each year that includes an hour of music with a local disc jockey. College sports events are another entertainment event that can add interest to a college-visitation plan.

A college open house—perhaps held in conjunction with the institution's general open house—provides another kind of opportunity to promote TPAD. Following the general format for student visits, open houses afford an opportunity for parents to tour the college, meet faculty, and learn more about the program and services offered at the college. Administrators, faculty, and staff from all areas of the college should be enlisted to participate in the open-house program. Tours and demonstrations can be scheduled at different times during the open house. Printed and audiovisual materials describing the TPAD program and the ensuing career opportunities should be readily available.

THE KEY TO MARKETING SUCCESS

Marketing a TPAD program effectively means showing that the program is both worthwhile and successful. Professionally designed materials, ongoing presentations and meetings, activities held at the college, and continued communication between high school and college will all contribute to this goal. However, research has shown that the single most important promotional tool for a TPAD program is word of mouth. Every segment of your marketing plan, therefore, should be designed to promote and support that positive word of mouth. After all, marketing is just one more way of spreading the good news that TPAD is truly a win-win situation.

Using Video and Other Media for Promotion

Larry McClure

Video is a an effective medium for reaching students about TPAD programs. What young person today cannot identify a television star, a video hit tune, a cartoon character, or a popular commercial jingle? Potential TPAD students have grown up in front of the tube and still spend hours watching it each week. Even classroom teachers are relying more and more on video resources as a vehicle for instruction.

An up-to-date program like TPAD, therefore, cannot rely totally on traditional print and poster strategies—though these have an important place in both catching the eye and providing detail. Video has its own distinctive role to play in TPAD promotion. Instead of offering the thoughtful reader a chance to mull or reflect on important facts, video grabs the viewer's attention. It offers a very immediate and personal look at the program and emphasizes the human factors which make TPAD successful.

Another advantage of video as a promotional tool for TPAD is its flexibility. Videography can be updated if program elements change at considerably less cost than in earlier days. If more contemporary background music is needed, if a key administrator featured in the video resigns, or if new articulation agreements are reached, new footage can be shot and edited into the master tape.

A locally shot TPAD video provides the opportunity to feature scenes and local celebrities that viewers will recognize—a particularly appealing element. Using a generic video developed regionally or nationally may be appropriate to some purposes, but viewers are less likely to identify with such a "canned approach."

PRODUCING A TPAD VIDEO

Whether the video is produced in-house or contracted to a professional group, you will need to answer several questions to assist the script writers in designing the program:

- What is the primary purpose of the video? To inspire? To inform? To motivate? To persuade?
- Who are the primary audiences? Who are the secondary audiences?
- Can potential TPAD employers be used to enhance the program?
- What are the questions of the primary audience?

Audience Considerations

Planners for video tools to enhance TPAD programs should list needs and concerns that each of the following groups may have and consider how videos can best address these needs:

Students will want to know:

- Are other students interested in TPAD?
- Is it a cool thing to be involved with?
- Will TPAD help me reach my goals? Be ready for a good career?
- What are the advantages of TPAD for me?
- How do I find out more?

Parents are interested in:

- Will TPAD open up more opportunities for my child?
- What are the costs in terms of time and money?
- Will my child still be able to go on to a four-year college or university?

Taxpayers are concerned about:

- Will this program cause our taxes for schools to increase?
- If programs like this are such a good idea, why haven't high schools and community/junior colleges become involved in them before now?

Employers will be asking:

- How will our workers be better prepared as a result of this kind of program?
- How will TPAD benefit the local business climate?

Counselors wonder:

- Is TPAD similar to the advanced-placement options I suggest to kids going on to college?
- Will this program mean any savings to parents who face higher college costs?

High-school and postsecondary faculty have their own concerns:

- Will TPAD give my students a head start on good jobs?
- Will my curriculum be affected by this program?
- What kind of say-so can I have in this system?

An effective TPAD video will address all these questions and concerns in a visually direct and interesting way.

The Question of Content

After considering the potential audience it's time to brainstorm precisely whom the video should reach, what it should say, and how that information can best be presented.

Some TPAD consortia have used a general video designed to reach several audiences—or at least to pique their curiosity enough that they will seek additional information. One consortium has produced a separate video for each program area offered at the community college and for each articulated program in each high school!

In most cases, people telling their own story seems to be the preferred style. Using the documentary or human-interest angle effectively shows TPAD's impact on people—which is the real message you are trying to convey. Simply listing programs and reviewing rules for enrolling is not a good use of this technology.

The best TPAD videos are written by people who have experience using this medium. Experienced video writers begin with an initial outline (storyboard) of what the video will cover. Some videos may use a script for certain parts of the video in which it is important for targeted information to be included. (A sample script is included at the end of this chapter.) Most TPAD videos produced so far also make use of on-the-spot interviews that allow the actual participants tell the story in their own words. Use of professional talent (people who have "starred" in videos or whose voices are used for narration) is an option—but it can be a costly one.

The following content do's and don'ts may be helpful:

1. *Think in advance about equality issues.* Make sure you include footage illustrating the racial and ethnic diversity of your area.

2. *Balance gender representation.* Make sure that both male and female teachers and narrators are featured. If students are included, more or less equal numbers of boys and girls should be shown. Avoid perpetuating stereotypes about "women's work" and "men's work" by showing both sexes in nontraditional programs/occupations—even if you have to stage this aspect of your video production.

3. *Remember that persons with disabilities are needed in today's work force.* Students with handicapping conditions can be just as successful in TPAD programs (with proper support services) as students we classify as "normal."

4. *Give "equal play" to all programs involved in TPAD agreements.* Even though there may be more students and more articulated courses in business education, for example, don't ignore programs with smaller enrollments and courses.

5. *Don't assume that the words and acronyms you use every day will be immediately understood by your audiences.* Convert these to lay language or define your terms the first time they appear.

6. *Do take advantage of the sights and sounds of the campuses involved.* Show the technology students will use, the settings they will encounter, and the faces they may soon recognize.

7. *Be sure to obtain permissions or "release forms" from all persons who will be featured in the video.* This can be done either at the time of "shooting" or before release.

8. *Beware of copyright laws protecting the use of recorded music.* Professional production houses use background music that does not require payment for reproduction.

9. *Always enter into writing and production agreements with a written contract—even if services are being donated.* Spelling out what each party will do and what resources he or she will provide is essential. Including a timeline in that agreement may also help everyone realize the importance of deadlines and careful planning.

PRODUCTION CONSIDERATIONS

Determining whether to self-produce a video or bring in an outside video "house" is simply a matter of money and standards. The adage, "you get what you pay for," certainly applies in this area.

If a staff member has a video camera and some basic editing equipment, know-how and experience, the end product might come out looking very good. On the other hand, some do-it-yourself videos have that "home style" look best left for weddings, family celebrations, and the school video yearbook. Yet high-end quality achieved with the help of professional videographers and communication consultants can cost as much as two thousand dollars per minute!

More than likely, the appropriate level of production is somewhere in between—perhaps right on the campus of the community college or vocational-technical center itself. Many postsecondary institutions have television-production studios either as part of a training program or as a service to the campus. Even some larger school systems or intermediate service agencies have talented media professionals who will take on nonprofit projects for little more than the cost of materials. Some communities have cable-access studios that are well equipped for high-quality production work—if experts can be found to run it. Finding some students who are looking for practical projects or freelancers who are looking for extra work can produce good results.

Using a committee to help plan the video's purposes, review the outline (storyboard), and screen the first version is probably a good idea. Don't hesitate to involve representatives of the target audience to help you reach other members of the group.

DISTRIBUTION STRATEGIES

Once a video has been produced, the next challenge is putting it before its target audience. This may require some creativity. Some TPAD programs have scheduled video showings in career centers, in regular classrooms, in cafeterias and student commons areas during lunchtime, or in counseling centers for small-group review. Videos can be used at student and parent orientations, school-board and college-trustee meetings, and professional-association meetings. Making TPAD videos available for free distribution through libraries and video rental stores is also a possibility.

OTHER AUDIOVISUAL MEDIA

While videos offer an unusually powerful and appropriate medium for today's television generation, there is also a time and place for more traditional media. Overhead transparencies or viewgraphs can help explain fine points of TPAD to large and small groups. Slides and slide-tape productions can be used very creatively in large forums; these offer the advantages of easy and fast updates with new slides. Audio tapes carrying the message of TPAD (perhaps told by older students who have been involved) can be prepared in large numbers for as little as fifty cents apiece.

"THE GOOD TIMES": A SUGGESTED TPAD VIDEO SCRIPT

The following script from the TPAD program at Portland Community College is included to illustrate some of the dialogue used to attract a student audience.

Program opens from black with title on screen "The Good Times."

Up from black to girl 1. ". . . and I'd like to be able to help other people, y'know, like maybe take care of children, maybe work in a hospital or something . . ."

Dissolve from girl 1 to boy 1. ". . . yeah, and I'd have the fastest car you've ever seen. With some nice seats, but fast . . . yeah . . . that's my dream . . ."

Dissolve from boy 1 to girl 2. ". . . earning the respect of the people I work with . . . having them know that I can do the job . . ."

Dissolve from girl 2 to boy 2. ". . . I want to do something in electronics . . . something special, y'know, like work on computers and stuff . . ."

Begin very slow zoom into classroom, narrator's voice begins. "You've probably been hearing it for years by now . . ."

Continue zoom to three shot of students talking—maybe about careers. "What are you going to do with your life?"

Pan to narrator, a high-school junior or senior, sitting at one of the desks. Other students don't see him/her talking to camera. Narrator fires questions rapidly. "How do you start a career? How do you find out what you want to do? What's right for you? Which jobs pay the best? Should you go to college? How will you pay for it?"

Head turn, narrator starts to get up. Music up slowly. "It's easy to ask the questions—but nobody seems to have any answers."

Narrator turns back to camera, says line, then turns and walks away. "Well, maybe, the Tech Prep/Associate Degree program is a place to start."

Dissolve to title sequence. Music in with title sequence. Dissolve to narrator standing in front of nice house, car in front of garage, kids playing on lawn, children's playful laughter in background. "Unemployment figures may not sound very exciting, but if you become one of those statistics . . . "

Narrator gestures to scene behind. ". . . you can forget your dreams about the good life—the nice car, a house of your own, and a happy, comfortable family . . . "

Narrator walks off frame, and background begins to dissolve away. ". . . man or woman, unless you're planning on inheriting a lot of money from a rich uncle."

Narrator is leaving empty-looking house, real-estate sign on lawn, kids, car and curtains gone. "The good life just won't happen without a good job."

Cut to close-up of narrator standing in high-school hallway.

"Do you have a rich uncle?"

Cut to machine-shop scenes, show complex tool and computers being operated by workers. "A machine-shop job used to be—'show up at eight and we'll show you what to do.'"

Cut to another machine-shop scene showing cut of automated operation-robotic arm, etc. "Today's machine shop may have more computers than machine operations in it . . . "

Cut to foreman-type looking at applicant's paper, shaking head no. ". . . and if you don't come with math and science skills and some very specific training, you won't even get an interview."

Cut to Portland Community College tech class scene.

"That's why a lot of people are going to two-year community colleges and getting an associate degree."

Cut to very high-tech-look jobs, clean-room scenes.

"There are a lot of good-paying jobs around now that didn't even exist a few years ago."

Cut to several industry scenes. "Jobs in computers, laser technology, and telecommunications are just a few examples where they need people with specialized, high-tech skills."

Cut to Portland Community College class scenes. "Portland Community College offers courses that prepare you for those kinds of technical jobs."

Cut to narrator as she/he pauses in front of door to an electronics tech or similar class. "People from local high schools and PCC have worked together to develop a program that lets you start developing a career in those fields now, while you're still in high school."

Cut to close-up of narrator's face. "It's called the Tech Prep/Associate Degree Program."

Cut to close-up of TPAD handbook. Hand reaches in and opens pages to show different programs. "Your counselors or teachers have a catalog like this, which lists two-year associate-degree programs that you can take at Portland Community College."

Cut to page showing a typical list of courses. "For each technical career, there is a list of courses you take here at high school during your junior or senior years . . . "

Cut to finger pointing to college course list. ". . . and the courses you take to complete that career program at Portland Community College."

Cut to PCC tech class scene; focus on one student. "When you finish taking this series of high-school and community-college courses, you've taken the shortest and best path to a technical degree."

Cut to same student in job setting. "And you'll have more than a degree . . . "

Cut to same student (worker) interacting with others in job setting. ". . . you'll have the skills you need to get a job—a good job."

Cut to wide shot of PCC campus. "There's a terrific variety of careers available in the TPAD program, too."

Cut to PCC tech classes. "Programs that build careers in jobs of the future . . . "

Cut to more PCC tech classes, match audio. ". . . like business and office technology, engineering, marketing, health care, computer sciences, drafting, graphics, mechanical careers, and metals—the list goes on and on . . . "

Cut to scenes of handicapped students using PCC facilities and working in PCC tech classes. "And it doesn't matter if you have a handicap or disability."

Cut to close-up of handicapped student in learning situation. "If you have the skills that are in demand, you will be needed and well-paid to work in those jobs."

Cut to one-shots of individuals in tech classes. "The Tech Prep/Associate Degree program is different from the traditional college prep/baccalaureate degree program."

Dissolve to boy 1 (finally accepting reality, but optimistically).

"Uncle Frank said he wouldn't let me touch a thing in his machine shop unless I checked out this Tech Prep/Associate Degree Program. . . . Hey, I was going to do it anyway. . . . It sounds real good . . . "

Dissolve to girl 2. ". . . and this might just give me some help even if I do go to a four-year school. . . . The way I see it, I just can't lose—the TPAD program is all right . . . "

Dissolve to boy 2. "You know, the electronics courses I'm taking in the TPAD program are just what I was looking for. It's something I can afford. And with the job I can get, I can earn the money to go on to State if I want to. I really am going to be an electrical engineer . . . really."

Computerizing Your Articulation Efforts

Greg Harpole

As we approach the year 2000, changes in technology are turning the workplace upside down. In response to these changes, vocational curricula at both the secondary and postsecondary levels must be able to change quickly as well. Because articulation promises to be a continuing focus for vocational programs, articulation systems must be capable of easy and quick updating. They must be able to reflect the rapidly changing curricula and deliver new information quickly to counselors, students, parents, and teachers.

Articulation agreements have traditionally developed out of lengthy discussions between secondary and postsecondary instructors. During these discussions, common elements of the two curricula are identified and the courses then redesigned to eliminate duplication and provide a smooth alignment between the two.

Although the course-to-course articulation resulting from this system has usually worked well, it is difficult for either secondary or postsecondary schools to change their curricula without affecting the articulation agreements. Considering the major changes that are anticipated in vocational and technical curricula, articulation relationships may prove difficult to maintain without a highly structured, flexible, easily accessed database that computer software offers.

A COMPUTER SOLUTION: OCCUPATIONAL ARTICULATION DATABASE SOFTWARE

The Occupational Articulation (OA) Database software, initially developed and implemented in Oregon, offers a high-tech alternative or supplement to existing articulation efforts. This software provides secondary and postsecondary schools with the opportunity to manage local articulation efforts through a computerized database while delivering tech-prep information to counselors, students, parents, and other populations.

The OA Database uses a comprehensive list of tasks/competencies for a specific vocational area as the nucleus for articulation, curriculum-development, and career-counseling efforts. Once a task list has been entered into the database, teachers at the secondary and postsecondary levels enter their own lists of tasks taught in their courses. These data, coupled with information about careers and postsecondary programs, allow the software to compare the tasks/competencies taught, identify the secondary equivalents of specific postsecondary courses, and prepare a series of reports—even a completely articulated TPAD curriculum. In essence, the Occupational Articulation Database software makes it possible to move from the time-consuming manual or semiautomated course-to-course articulation to a technology-driven, competency-based articulation.

A BASIS FOR COMPARISON

Comparison is the primary business of the OA Database software. The entry of the comprehensive task list, career data, secondary course data, and postsecondary data provides the database with the information necessary to make a series of menu-driven comparisons. These comparisons can be valuable to counselors, students, instructors, and administrators.

Comparisons made possible through the OA Database software include:

1. *Curriculum Development Comparisons.* A specific group of secondary or postsecondary courses can be compared to a specific career to identify the tasks that are taught and not taught for that career. Identifying these tasks provides teachers with a list of the areas where curriculum development is needed to improve student employability and/or articulation.

2. *Course Articulation Comparisons.* In addition, the tasks taught in a secondary course or courses can be compared to a specific postsecondary course to identify the percentage of matching tasks and to identify a list of the tasks that are not taught. This option allows secondary teachers to identify "missing links" in their curriculum that

may prevent secondary students from receiving credit for postsecondary courses.

3. *Complete Articulation Comparisons.* It is even possible to compare the tasks taught in a specified group or all secondary courses to the entire postsecondary curriculum to identify the percentage of matching tasks for each postsecondary course. This comparison demonstrates to the student, teacher, and counselor the specific secondary courses a student would need to take to complete the competencies identified for a specific postsecondary course.

4. *2+2 Program Comparisons.* Comparing the tasks for all secondary and postsecondary courses results in a semester-by-semester plan to help high-school students receive maximum articulation credit.

5. *Career Comparisons.* Comparing a specific group of secondary or postsecondary courses to a career or careers will identify percentages of matching tasks, tasks taught, and tasks not taught. This option helps students focus their training by comparing the tasks they have accomplished to those needed for a specific career. The resulting list of tasks not taught can be used to assist with the development of course schedules, individual education plans, and work-based learning plans.

OTHER USES OF THE DATABASE

The Occupational Articulation Database software can have tremendous impact on formal and informal counseling, not only through the comparisons it can make, but also through its ability to display or print specific course, career, and program information. A task list can be printed for specific secondary and postsecondary courses and programs, as well as for specific careers. This information can be especially helpful for students who want to review what is being taught in a course, where they can learn a specific task or group of tasks, and what tasks are required for a specific career.

ARTICULATION ON THE MENU—SYSTEM SPECIFICS

To operate the software, the following system configuration is required:

- IBM PC, PC-XT, PC-AT, PS-2, or IBM-compatible systems,
- at least 320K RAM,

- two disk drives—either two double-sided diskette drives, or one double-sided drive and a fixed disk,
- DOS version 2.xx or 3.xx, and
- monochrome, color, or gray-scale monitor.

The database is most often obtained through an entire postsecondary district and supervised by the postsecondary institution, with copies provided to each middle or secondary school. In the schools, the database can be used on any available PC-compatible computer—in classrooms, counseling centers, and so forth.

ARTICULATION ON THE MENU

The database is a user-friendly piece of software with which students, teachers, and counselors will become proficient in a short time. Like most software, entering the initial data for the software to compare will take some time. Once the data has been entered, however, information within the database can easily be added, deleted, or changed.

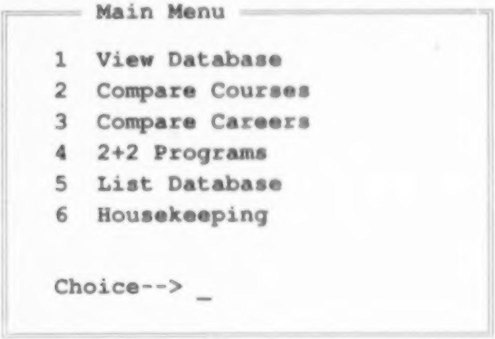
To access information through the database, the student, teacher, or counselor will go through a series of menus to select the specific function they want to access (figure 1 shows the main menu). Online help is available for each of the functions. Each menu refers to function keys that open up a dialogue window at the bottom of the screen. All output can be displayed on the screen, printed, or saved to a disk. An example of an entry screen is shown in figure 2.

IMPLEMENTING THE OA DATABASE

The Occupational Articulation Database software was initially developed and implemented in Oregon through a combined effort of the Lane County Vocational Education Consortium and Lane Community College in collaboration with a software-development company. The Lane County project included the preparation of a comprehensive task list for twenty office systems and accounting/financial-systems careers. Business and industry representatives validated approximately 1250 individual tasks.

Implementing the database in the state of Oregon involved the following steps:

- identification (by local schools and employer representatives) of careers to be included in the project;



```
Main Menu

1   View Database
2   Compare Courses
3   Compare Careers
4   2+2 Programs
5   List Database
6   Housekeeping

Choice--> _
```

1. *View Database* allows for the entry of database information—tasks for high-school courses, tasks for community-college courses, tasks for careers, and courses for community-college programs.

2. *Compare Courses* compares tasks for community-college and high-school courses to identify similarities in course content. This option identifies tasks that compare, tasks that do not compare, and the percentage of tasks that do compare. Submenus below this menu option allow for comparison of all courses or specific courses.

3. *Compare Careers* compares a specific career to a high-school or community-college curriculum to identify the tasks that compare and do not compare. This option assists in curriculum development.

4. *2+2 Programs* compares the tasks taught in high-school and community-college courses to a specific community-college program. Output provides for the high-school student a suggested four-year (2+2) curriculum that identifies the high-school and community-college courses to be taken as well as listing the community-college courses for which credit can be granted.

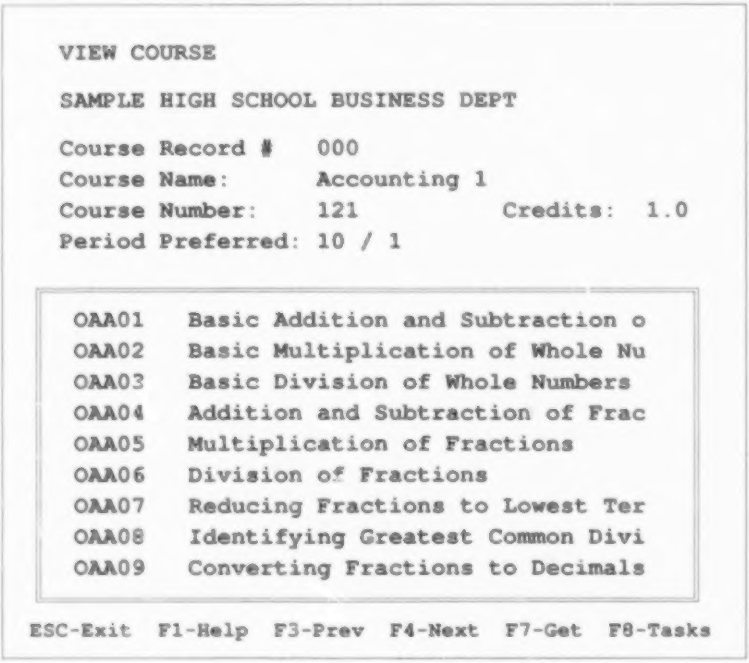
5. *List Database* lists the tasks, tables, and performance guides within the database.

6. *Housekeeping* allows the database user to set up or change parameters within the database itself.

Figure 1: Main Menu for OA Database Software

- identification of existing task lists and merging of task lists into a comprehensive document;
- validation of task lists and performance guides by local employer representatives;

- review of validated task lists by local teachers to identify competencies to be added to the task lists;
- identification (by employer representatives) of the tasks necessary for success in specific careers;
- entry of task lists, performance guides, and career data into the database;
- entry of task data for courses and programs by secondary and postsecondary instructors; and
- inservices for teachers on the use of the software for curriculum improvement, career counseling, and articulation.



```
VIEW COURSE

SAMPLE HIGH SCHOOL BUSINESS DEPT

Course Record #   000
Course Name:      Accounting 1
Course Number:    121          Credits:  1.0
Period Preferred: 10 / 1

  OAA01   Basic Addition and Subtraction o
  OAA02   Basic Multiplication of Whole Nu
  OAA03   Basic Division of Whole Numbers
  OAA04   Addition and Subtraction of Frac
  OAA05   Multiplication of Fractions
  OAA06   Division of Fractions
  OAA07   Reducing Fractions to Lowest Ter
  OAA08   Identifying Greatest Common Divi
  OAA09   Converting Fractions to Decimals

ESC-Exit  F1-Help  F3-Prev  F4-Next  F7-Get  F8-Tasks
```

Figure 2: Sample Screen for OA Database Software

The OA Database software can be adapted for use in any vocational area as long as a task list is available for that area. Task lists can be prepared through a local consortium. Many are already available through the Vocational Technical Education Consortium of States and many other sources.

The Occupational Articulation Database is more than a piece of software; it is a valuable tool for course articulation, curriculum development, and career counseling. The software makes it possible to update information about courses and programs easily and to run comparisons between courses, curricula, and careers at any time.

Using Counselor Handbooks And Student Guides to Promote TPAD and Counsel Effectively

Al Miller

Most of us, thinking back on our high-school days, can remember at least one person who always made us think. That person just seemed to have sound ideas and the right information. His or her advice made sense because it fit our needs at that time. That is the kind of person every high-school counselor—and everyone charged with guiding and directing students—should strive to be. Advising students is a counselor's most challenging responsibility. It requires both the right information and the right timing if it is to motivate students to think—and to act.

High-school students are faced with important decisions—decisions that could affect the entire course of their later lives. But too often, unfortunately, such important decisions are made too quickly, with little discrimination and guidance. The decision of which classes to take each year is a prime example. Too many students choose their classes with little more purpose than taking what is required, avoiding "boring" or "hard" classes, making time for extracurricular activities, and perhaps pursuing personal interests such as sports or hobbies.

If we take a close look at the way course information is presented to high-school students, it is no wonder that little thought goes into the decision. Certain courses must be taken each year to meet specific graduation requirements. After scheduling those required courses, the student is allowed to choose from one to four—or maybe five—electives. These electives are displayed (listed and described) alphabetically within various subject areas such as mathematics, science, business, home economics, and industrial education.

Beginning with grade nine, the student is urged to make a four-year high-school "plan." That means that she or he is to identify which electives will be taken each year. But the student is given little information about which courses will provide the best preparation for what will come after high school. Unless the courses are sequential, the student doesn't know which courses complement and build upon each other. As a result, the choice of electives becomes little more than random.

THE KEY WORD IS *PROGRAM*

Planning without information is not planning. Students frequently don't understand what they will be prepared for when they graduate, so they find it difficult to do any kind of focused planning. What they need is an identifiable program.

A useful high-school program includes the same kinds of things that make an undergraduate or graduate college program, or major—a series of related courses that build on one another and result in an identifiable body of knowledge or set of skills. The closest thing to a program that can be found in most high schools is the traditional college-prep course of studies. In a college-prep program, a student does take a predetermined set of courses that are required for admission to a four-year college or university. (These requirements vary according to the kind of college the student plans to attend.)

Not every high-school student, however, can or should be in a college-prep program. Nationally, less than 40 percent of all high-school graduates attend college. (This number includes both two-year and four-year institutions). And only about half of those who pursue higher education end up earning baccalaureate degrees. The other half may complete two-year associate degrees or certificate programs at a community college, but many end up completing nothing.

What becomes of these students—not to mention the 60 percent of high-school graduates who do not pursue further education after high school? Their high-school education typically does little to prepare them for their next endeavor, which typically means immediate entry into the work force.

Many educators, and a growing number of employers, have recognized that most high-school graduates are indeed not ready for the job market. Rapidly changing technology has made the "skills gap" between what students can do and what employers need just too wide. And existing "vocational education" programs often fail to give students the academic understanding they need to retrain if their specific training later becomes obsolete.

It was to address this problem that the tech-prep program arrived on the high-school scene. The key word is *program*. Underlying the concept of "program" at the high-school level are the elements of preparation and planning. College prep is a planned sequence of courses that prepares students to seek a baccalaureate degree. And tech prep is a planned sequence that prepares students to seek a technical associate degree or certificate or, if further education is not possible, to enter the job market with viable skills.

A high-school program, by its very nature, should be planned, preparatory, and based on solid academic content. How else can a person—college-bound or not—be prepared for our modern "information society"? The tech-prep program, which blends academic preparation with guided vocational and technical preparation, offers non-baccalaureate-bound students employable skills as well as the kind of planned, relevant course of study all students need.

TPAD GUIDEBOOKS FOR COUNSELORS AND STUDENTS

Tech prep is not a familiar notion among high-school counselors or high-school students, nor will it become familiar overnight. There has to be some method to make this program visible and recognizable. Developing guidebooks is one way of getting information about the program in the hands of the students who need it and the counselors who guide them.

The Portland Area Vocational Education Consortium (PAVTEC) in Portland, Oregon, has developed such a set of guidebooks for its 2+2 program: the *2+2 Tech Prep Program Student Guide* and its companion *2+2 Counselor Handbook*. These two guidebooks were designed to show the alignment of the high-school tech-prep programs with the two-year associate of applied science (AAS) degree programs offered at Portland Community College. Hillsboro Union High School District, a member of PAVTEC, includes forty-six 2+2 programs in its third edition of the student guide.

The first step in developing these tools was to compare high-school technical programs with the college's technical programs. And what immediately became apparent was that comparing the two programs was like comparing apples and oranges.

The difference was not so much in content as in *structure*. (The college, of course, had more technical programs than the high schools, but a single high-school program could be matched with several related college programs.) High-school vocational technical programs were typically specialized courses, such as electronics or auto mechanics, taken as electives. The community-college technical programs, however, had a structure:.

- They included core academic or general-education courses as well as the specialized courses.
- They were usually sequential.
- They constituted a full schedule for the student.

The current PAVTEC TPAD program, as reflected in the 2+2 *Program Student Guide*, gives a similar structure to the high-school tech-prep program. Grades eleven and twelve are each laid out as a complete program. Appropriate academic courses are included as the basis for the specialized technical courses. Both the academic and technical courses are sequential. And the combination of required classes, tech-prep classes, and some electives makes up a full schedule for the student.

The counselor handbook follows the same principle as the student guide; it encourages the counselor to think in terms of a structured, sequential, and goal-directed program. The counselor is directed to advise the student in choosing an appropriate sequence of academic and technical courses leading to a specific associate-degree program. The guide uses a template format—the same physical format is repeated for each program listing—to ensure that the tech-prep program follows the same general program structure as the associate-degree program (figures 1 and 2).

FEATURES AND BENEFITS OF THE TPAD GUIDEBOOKS

Any practicing high-school counselor will acknowledge that getting the student's attention is the first thing that must happen in advising. This implies the need for simplicity, brevity, and familiarity—plus incentive. The PAVTEC TPAD guidebooks have tried to incorporate these hallmarks into their design.

1. *Simplicity*. The information pertaining to each TPAD program is presented in an uncomplicated and direct fashion. Every program is shown in identical format. All of the course titles and credits for each year, eleven through fourteen, are stated or implied (figures 3 and 4) in a columnar layout.

2. *Brevity*. The complete information for each TPAD program is contained on a single page in the handbook and student guide. While high-school students are capable of doing research, they are not likely to bother with a lot of skipping around for this information, even in a single volume. The student guide, therefore, condenses the important

2+2 TECH PREP ASSOCIATE DEGREE

HIGH SCHOOL

Grade 11		**Grade 12**	
SEMESTER 1		**SEMESTER 1**	
Required Course	***Cr***	***Required Course***	***Cr***
Recommended Course	***Cr***	***Recommended Course***	***Cr***
SEMESTER 2		**SEMESTER 2**	
Required Course	***Cr***	***Required Course***	***Cr***
Recommended Course	***Cr***	***Recommended Course***	***Cr***
TOTAL		**TOTAL**	

COMMUNITY COLLEGE

Grade 13	**Grade 14**
First Term	Fourth Term
Second Term	Fifth Term
Third Term	Sixth Term

Figure 1: Tech Prep Template

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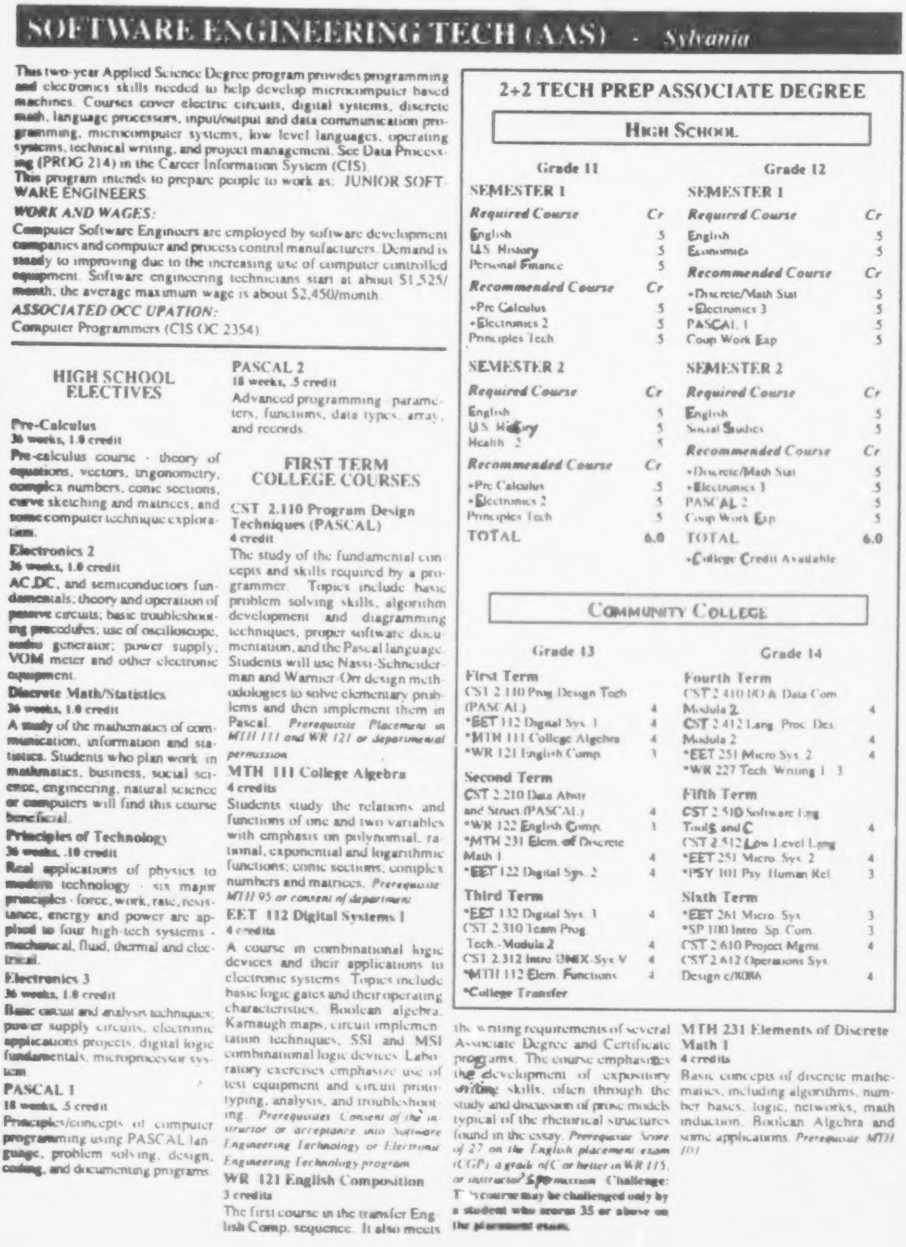

SOFTWARE ENGINEERING TECH (AAS) - *Sylvania*

This two-year Applied Science Degree program provides programming and electronics skills needed to help develop microcomputer based machines. Courses cover electric circuits, digital systems, discrete math, language processors, input/output and data communication programming, microcomputer systems, low level languages, operating systems, technical writing, and project management. See Data Processing (PROG 214) in the Career Information System (CIS).

This program intends to prepare people to work as: JUNIOR SOFTWARE ENGINEERS.

WORK AND WAGES:

Computer Software Engineers are employed by software development companies and computer and process control manufacturers. Demand is steady to improving due to the increasing use of computer controlled equipment. Software engineering technicians start at about $1,525/month, the average maximum wage is about $2,450/month.

ASSOCIATED OCCUPATION:

Computer Programmers (CIS OC 2354)

2+2 TECH PREP ASSOCIATE DEGREE

HIGH SCHOOL

Grade 11

SEMESTER 1

Required Course	*Cr*
English	.5
U.S. History	.5
Personal Finance	.5

Recommended Course	*Cr*
•Pre Calculus	.5
•Electronics 2	.5
Principles Tech	.5

SEMESTER 2

Required Course	*Cr*
English	.5
U.S. History	.5
Health 2	.5

Recommended Course	*Cr*
•Pre Calculus	.5
•Electronics 2	.5
Principles Tech	.5
TOTAL	6.0

Grade 12

SEMESTER 1

Required Course	*Cr*
English	.5
Economics	.5

Recommended Course	*Cr*
•Discrete/Math Stat	.5
•Electronics 3	.5
PASCAL 1	.5
Coop Work Exp	.5

SEMESTER 2

Required Course	*Cr*
English	.5
Social Studies	.5

Recommended Course	*Cr*
•Discrete/Math Stat	.5
•Electronics 3	.5
PASCAL 2	.5
Coop Work Exp	.5
TOTAL	6.0

•College Credit Available

COMMUNITY COLLEGE

Grade 13

First Term	
CST 2.110 Prog Design Tech (PASCAL)	4
*EET 112 Digital Sys. 1	4
*MTH 111 College Algebra	4
*WR 121 English Comp.	3
Second Term	
CST 2.210 Data Abstr and Struct (PASCAL)	4
*WR 122 English Comp.	3
*MTH 231 Elem. of Discrete Math 1	4
*EET 122 Digital Sys. 2	4
Third Term	
*EET 132 Digital Sys. 3	4
CST 2.310 Team Prog Tech.-Modula 2	4
CST 2.312 Intro UNIX-Sys V	4
*MTH 112 Elem. Functions	4

Grade 14

Fourth Term	
CST 2.410 I/O & Data Com Modula 2	4
CST 2.412 Lang. Proc. Des. Modula 2	4
*EET 251 Micro Sys. 2	4
*WR 227 Tech. Writing 1	3
Fifth Term	
CST 2.510 Software Eng Tools and C	4
CST 2.512 Low Level Lang	
*EET 251 Micro Sys. 2	4
*PSY 101 Psy. Human Rel.	3
Sixth Term	
*EET 261 Micro Sys.	3
*SP 100 Intro. Sp. Com.	3
CST 2.610 Project Mgmt.	4
CST 2.612 Operations Sys. Design c/8086	4

*College Transfer

HIGH SCHOOL ELECTIVES

Pre-Calculus
36 weeks, 1.0 credit

Pre-calculus course - theory of equations, vectors, trigonometry, complex numbers, conic sections, curve sketching and matrices, and some computer technique exploration.

Electronics 2
36 weeks, 1.0 credit

AC,DC, and semiconductors fundamentals; theory and operation of passive circuits; basic troubleshooting procedures; use of oscilloscope, audio generator; power supply; VOM meter and other electronic equipment.

Discrete Math/Statistics
36 weeks, 1.0 credit

A study of the mathematics of communication, information and statistics. Students who plan work in mathematics, business, social science, engineering, natural science or computers will find this course beneficial.

Principles of Technology
36 weeks, .10 credit

Real applications of physics to modern technology - six major principles - force, work, rate, resistance, energy and power are applied to four high-tech systems - mechanical, fluid, thermal and electrical.

Electronics 3
36 weeks, 1.0 credit

Basic circuit and analysis techniques; power supply circuits, electronic applications projects, digital logic fundamentals, microprocessor system.

PASCAL 1
18 weeks, .5 credit

Principles/concepts of computer programming using PASCAL language, problem solving, design, coding, and documenting programs.

PASCAL 2
18 weeks, .5 credit

Advanced programming - parameters, functions, data types, array, and records.

FIRST TERM COLLEGE COURSES

CST 2.110 Program Design Techniques (PASCAL)
4 credit

The study of the fundamental concepts and skills required by a programmer. Topics include basic problem solving skills, algorithm development and diagramming techniques, proper software documentation, and the Pascal language. Students will use Nassi-Schneiderman and Warnier-Orr design methodologies to solve elementary problems and then implement them in Pascal. *Prerequisite: Placement in MTH 111 and WR 121 or departmental permission.*

MTH 111 College Algebra
4 credits

Students study the relations and functions of one and two variables with emphasis on polynomial, rational, exponential and logarithmic functions; conic sections; complex numbers and matrices. *Prerequisite: MTH 95 or consent of department.*

EET 112 Digital Systems I
4 credits

A course in combinational logic devices and their applications to electronic systems. Topics include basic logic gates and their operating characteristics, Boolean algebra, Karnaugh maps, circuit implementation techniques, SSI and MSI combinational logic devices. Laboratory exercises emphasize use of test equipment and circuit prototyping, analysis, and troubleshooting. *Prerequisites: Consent of the instructor or acceptance into Software Engineering Technology or Electronic Engineering Technology program.*

WR 121 English Composition
3 credits

The first course in the transfer English Comp. sequence. It also meets the writing requirements of several Associate Degree and Certificate programs. The course emphasizes the development of expository writing skills, often through the study and discussion of prose models typical of the rhetorical structures found in the essay. *Prerequisite: Score of 27 on the English placement exam (CGP) a grade of C or better in WR 115, or instructor's permission.* **Challenge: This course may be challenged only by a student who scores 35 or above on the placement exam.**

MTH 231 Elements of Discrete Math 1
4 credits

Basic concepts of discrete mathematics, including algorithms, number bases, logic, networks, math induction, Boolean Algebra and some applications. *Prerequisite: MTH 111*

Figure 2: Sample Program Listing

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information about each topic—program description, expected career and salary information for graduates, career titles, and course descriptions—into a single paragraph. Sources of additional information are given for the more dedicated students.

3. *Familiarity.* The TPAD guidebooks use specific, recognizable course titles rather than the generic titles (i.e., mathematics, English, science) often used in college brochures. These generic titles are necessary in materials that must address a very broad audience, but they tend to lose a student's attention quickly. If the course titles are taken directly from the high-school curriculum catalog—for example, Applied Tech Math, Speech 1, or Principles of Technology—the student recognizes them and is more likely to feel comfortable with the overall program.

Another familiar feature in the guidebooks is the combining of required and elective courses. (After all, even tech-prep class schedules must fulfill graduation requirements!) The handbook template for grades eleven and twelve is set up for counselors and students to fill in courses in these two categories. The student guide has these courses already included.

4. *Incentive.* "If I could tell you how to begin earning college credits while you are still in high school, would you be interested?" That gets a student's attention quickly! Nearly every TPAD program provides the opportunity for students to earn some college credits. In some cases, the student can apply for college credit upon completing certain articulated high-school courses. Another option is for students actually to go to the college and take classes that have been included in the program through an agreement between the high school and community college. The Hillsboro-PCC student guide lists thirty-two different college courses for which high-school students can obtain credit. These high school courses are flagged so the students can readily understand what the counselor is advising them to do.

USING THE GUIDEBOOKS TO COUNSEL FOR TPAD

TPAD guidebooks—both the student guide and the counselor's handbook—are primarily counseling tools. Their purpose is to assist the counselor in:

- understanding TPAD (the programs and the possibilities),
- promoting the program to students, and
- helping students planning a particular course of study.

**ELECTRONIC TECHNOLOGY
TECH PREP PROGRAM**

HIGH SCHOOL

Grade 11		Grade 12	
SEMESTER 1		**SEMESTER 1**	
Recommended Course	***Cr***	***Recommended Course***	***Cr***
English	.5	English	.5
U.S. History	.5	Economics	.5
Personal Finance	.5	***Elective Course***	***Cr***
Elective Course	***Cr***	+Pre Calculus	.5
+Appplied Math	.5	+Electronics 3	.5
+Electronics 2	.5	PASCAL 1	.5
Principles Tech./Physics	.5	+Drafting 2	.5
SEMESTER 2		**SEMESTER 2**	
Recommended Course	***Credit***	***Recommended Course***	***Credit***
English	.5	English	.5
U.S. History	.5	Social Studies	.5
Health 2	.5	***Elective Course***	***Cr***
Elective Course	***Cr***	+Pre Calculus	.5
+Applied Math	.5	+Electronics 3	.5
+Electronics 2	.5	PASCAL 2	.5
Principles Tech./Physics	.5	+Drafting 2	.5
TOTAL 6.0		**TOTAL**	**6.0**

+College Credit Available

Figure 3: High-School TPAD Program

But potential TPAD students are not all alike, and more than just a handbook is required to guide any of them effectively. The particular approach a counselor takes will depend on students' attitudes and interests, the grade they are in or entering, and the particular configuration of the TPAD program.

Counseling Job-Oriented Students

Some students, for instance, are clear about their overall employment goals, whether those goals are specific ("I want to be a nurse.") or more general ("I don't want to go to a university, I just want to get a good job.") These students, many of whom are impatient with traditional academics and eager to get out of school, may be attracted to specialized technical courses.

Because more than specialized skills are needed in today's job market, counselors need to point job-oriented students toward courses of study that help them obtain the specialized skills they want while also acquiring the solid background they need. Counselors may have to sell the idea of applied-academic courses to support the technical courses. It may be especially helpful to compare the tech-prep program to the college's technical program. Matching similar technical courses between the two may help make the case for aligning academic courses between the two levels as well.

ELECTRONIC ENGINEERING TECHNOLOGY ASSOCIATE DEGREE PROGRAM

COMMUNITY COLLEGE

Grade 13

First Term

*EET 110 Prog. for Elec.	3
*EET 111 Elec. Cir. Dev. 1	4
*EET 112Digital Sys. 1	4
*MTH 111 College Algebra	4
*WR 121 English Comp.	3

Second Term

*EET 121 Elec. Cir. Dev.	4
*EET 122 Digital Sys. 2	4
*MTH 112 Elementary Funct.	4
*WR 122 English Comp.	3
CST 2.110 Program Design Tech. (PASCAL)	4

Third Term

*EET 131 Elec. Circ. Dev. 3	4
*EET 132 Digital Sys. 3	4
*EET 133 Calculus for Elec.	4
*WR 227 Tech. Writing 1	3
CST 2.666 UNIX and C	4

Grade 14

Fourth Term

*EET 241 Micro Sys. 1	4
*EET 242 Linear Sys. 1	4
*EET 243 RF Com. Sys.	4
*EET 244 Seminar 1	1
Elective	4

Fifth Term

*EET 251 Micro. Sys. 2	4
*EET 252 Linear Sys. 2	4
*EET 254 Seminar 2	1
*PHY 201 General Physics	4
Elective	4

Sixth Term

*EET 261 Micro. Sys. 3	4
*EET 262 Power Elec.	4
*PHY 202 General Physics	4
Elective	4
General Education	3

***College Transfer**

Figure 4: Community-College TPAD Program

Counseling Undirected Students

Many students—at least half of a typical-high school population—are unsure and unfocused about their post-graduation intentions. One reason for this may be that we in the high schools haven't offered enough help.

By inclination, not to mention parental and societal pressure, these students tend to believe that they will be going to college, but they have done little thinking about what they will do in college, what they expect to do afterward, or whether a baccalaureate degree is either possible or desirable for them. This combination of college expectations and vague goals tends to cause a sort of inertia that prevents them from truly pursuing any other kind of bona fide program in high school. The result is that they neither go to college nor properly prepare to go to work.

A counselor can use the TPAD guidebooks to help the undirected student with his or her dilemma. Selling the merits of TPAD to this kind of student involves a different set of challenges than those encountered with the vocational student. The undirected student is not necessarily neglectful of academic preparation (although many are). But this kind of student is relatively uninterested in learning specific job applications or skills. They may even look down on "vocational" training. The most effective tool to use for advising these students, therefore, is one which shows how academic and technical preparation combine to build a respectable—and lucrative—career.

Formative and Summative Advising

In the past, with the exception of those students who are headed toward some kind of professional career, schools have intentionally shied away from urging this kind of focus. The justification usually given for this posture is, "We don't want to run the risk of limiting their options." In the process, schools have limited students' options even more—by letting those students graduate from high school without the skills they need to move forward.

With this in mind, I believe we must change our attitude toward advising students in high school. Our emphasis must be in helping them focus on where they want to go (even if they later change this focus) and choose courses that move them in that direction.

The particular emphasis of high-school guidance sessions should shift as the student moves toward graduation. From grade nine, the very first year in high school, we should begin *formative* advising—helping the students shape the course of their high-school education. Both students and parents should be included in the process. Counseling should involve both immediate concerns, such as available high-school programs, and more long-term issues, such as continuing education and a career. In the earlier grades, however, attention will focus more on the high-school years, and the primary decisions will involve what course of study to take.

If the student and parent can see an assortment of different high-school programs which point toward various continuing-education and career paths, they find it easier to choose from among them—especially if they can see that these programs are complete with academic as well as technical subjects. There is less fear of "limiting" future options, and greater clarity about potential benefits to the student. The TPAD counselor handbook and student guide can therefore be of great benefit in this formative advising process.

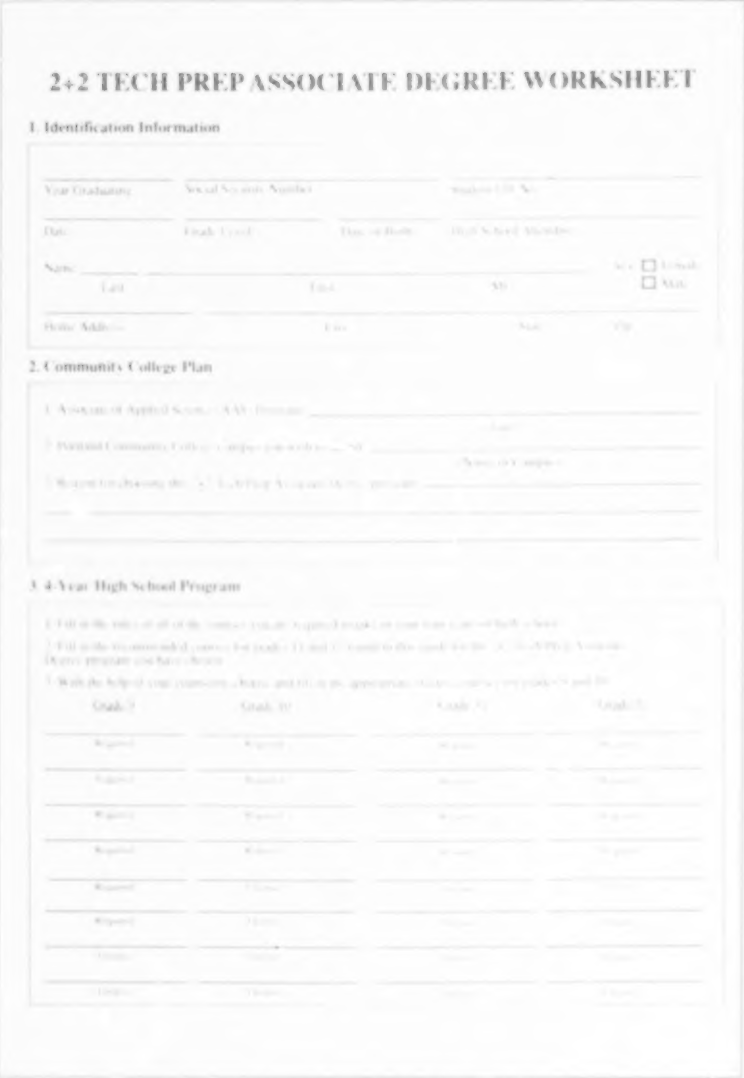
In Portland, the student guide has been used successfully at several points in the process of formative advising. It has been distributed at career classes and used when annual registration takes place for next year's classes. References to the guide are scattered throughout the high school's curriculum catalog to remind students to plan before they choose next year's subjects. A "TPAD Tech-Prep Associate Degree Worksheet" has been recently added to the student guide to help students plan, beginning in the ninth grade (figure 5).

TPAD guidebooks are especially useful at the point of formal registration for TPAD programs (figure 6). When this happens depends on the particular configuration of the program; 2+2 programs register students prior to the eleventh grade, 4+2 programs before the ninth. With appropriate guidance, students will be prepared to focus their preparation for TPAD. They will also be able to understand that, once they have chosen, they will still have many possible avenues ahead.

Most high-school counseling as now practiced takes the form of formative advising. To be most effective, however, advisement should also have a *summative* element. This means helping students near the end of their high-school days to focus on what they have done and where they are going next. Except for those students who apply for the four-year colleges, our schools currently do a poor job of summative evaluation.

A helpful goal for summative advising is to ensure that each and every young person leaves high school with a portfolio and an application. The portfolio is a summary of the student's credentials, both educational and experiential. It should include scholastic records; extracurricular and community activities; work experiences; examples of student papers; and copies, pictures, or descriptions of completed projects. A portfolio gives the student a clear picture of what he or she has accomplished and introduces the student to the next phase of continued learning, be it formal or informal.

An application might be for an entry-level job leading to a career, a postsecondary educational institution, or some type of service program. Without this application, which should be submitted before graduation, the student's immediate future will be left totally to chance. The graduating seniors who are the most envied by their peers and in whom educators take most pride are those who are going



2+2 TECH PREP ASSOCIATE DEGREE WORKSHEET

1. Identification Information

Year Graduating ____ Social Security Number ____ Student I.D. No. ____

Date ____ Grade Level ____ Date of Birth ____ High School Attending ____

Name ____ Last ____ First ____ MI ____ Sex ☐ Female ☐ Male

Home Address ____ City ____ State ____ Zip ____

2. Community College Plan

1. Associate of Applied Science (AAS) Program ____ (Title)

2. Portland Community College campus you wish to attend ____ (Name of Campus)

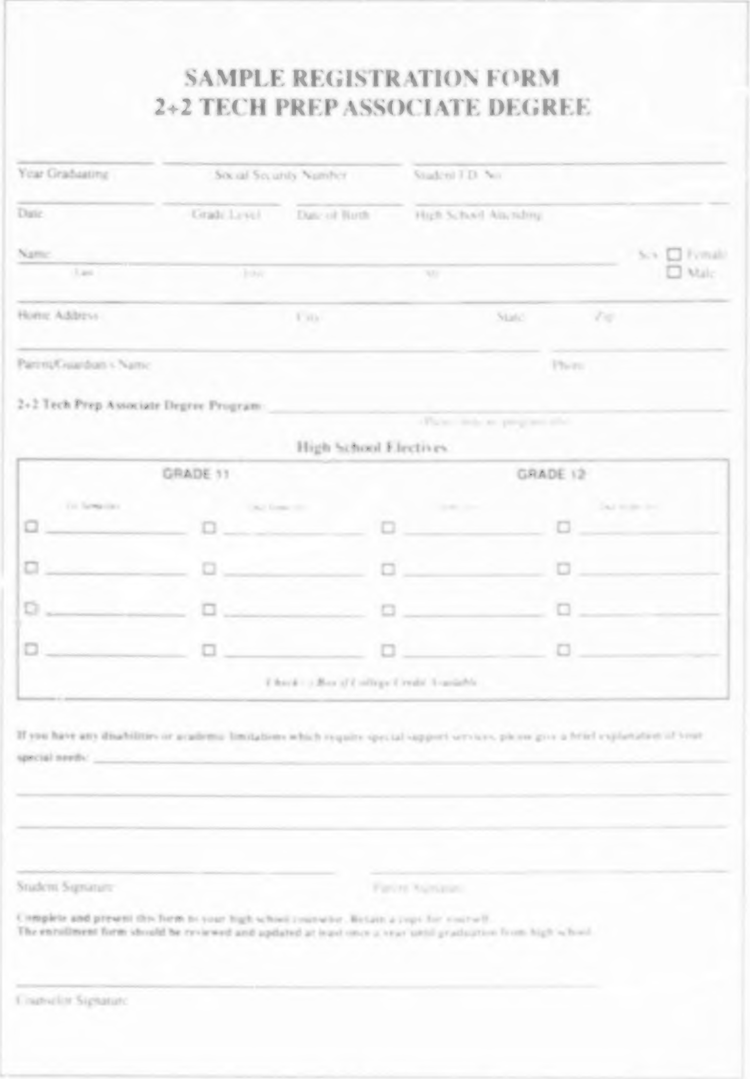
3. Reason for choosing this 2+2 Tech Prep Associate Degree program ____

3. 4-Year High School Program

Grade 9	Grade 10	Grade 11	Grade 12
Required	Required	Required	Required
Required	Required	Required	Required
Required	Required	Required	Required
Required	Elective	Required	Required
Required	Elective	Elective	Elective
Required	Elective	Elective	Elective
Elective	Elective	Elective	Elective
Elective	Elective	Elective	Elective

Figure 5: TPAD Worksheet

somewhere—moving forward toward some other challenging endeavor. The goal of summative advising is to make sure every graduating student has some place to go.



SAMPLE REGISTRATION FORM
2+2 TECH PREP ASSOCIATE DEGREE

Year Graduating ______ Social Security Number ______ Student I.D. No. ______

Date ______ Grade Level ______ Date of Birth ______ High School Attending ______

Name ______ (Last) (First) (MI) Sex ☐ Female ☐ Male

Home Address ______ City ______ State ______ Zip ______

Parent/Guardian's Name ______ Phone ______

2+2 Tech Prep Associate Degree Program: ______
(Please write in program title)

High School Electives

GRADE 11		GRADE 12	
1st Semester	2nd Semester	1st Semester	2nd Semester
☐ ______	☐ ______	☐ ______	☐ ______
☐ ______	☐ ______	☐ ______	☐ ______
☐ ______	☐ ______	☐ ______	☐ ______
☐ ______	☐ ______	☐ ______	☐ ______

Check ( ) Box if College Credit Available

If you have any disabilities or academic limitations which require special support services, please give a brief explanation of your special needs: ______

Student Signature ______ Parent Signature ______

Complete and present this form to your high school counselor. Retain a copy for yourself.
The enrollment form should be reviewed and updated at least once a year until graduation from high school.

Counselor Signature ______

Figure 6: TPAD Registration Form

USING THE GUIDEBOOKS TO PROMOTE FACULTY ACCEPTANCE

As earlier chapters have clearly shown, faculty buy-in is essential to the success of any TPAD program. Achieving articulation between courses of study requires a close working relationship between secondary and postsecondary, academic and technical personnel. The TPAD counselor handbook and student guide, with their clear summary of articulated programs, can help facilitate this relationship.

The TPAD guidebooks fully display each articulated program with a full complement of appropriate academic and technical courses at each level of education. The justification for the high-school tech-prep courses is borne out by the similar display of requirements for the college's associate-degree program which shows how secondary tech-prep courses fit in.

These displays can help dissolve any hesitation on the part of faculty to articulate courses between disciplines or between educational levels. And if the instructors have led the way in connecting the curriculum, the handbook and guide reinforce this connection.

CREATING THE TPAD GUIDEBOOKS

Preparing the counselor handbook and student guide is primarily a process of compiling information and presenting it in simple, concise, and compelling form. Assuming that the TPAD programs have already been articulated between a high school and a community college, here are some tips for putting these guidebooks together:

- Obtain from the Curriculum Development Committee (or from whoever has been charged with articulating curricula) a complete list of articulated TPAD curricula.
- Develop a brief description for each TPAD program, for the high-school courses, and for at least the first term of college courses.
- Obtain and add a digest of the regional employment outlook and income potential for future graduates of TPAD programs.
- Excerpt information from the community-college catalog which describes admissions procedures, academic regulations, tuition costs, and financial aid.
- Prepare an overview which describes the nature and makeup of TPAD programs (see figure 2).

- Create a worksheet for student planning and a registration form to be used when students are ready to enroll.

ONE MORE WAY OF SPREADING THE WORD

The TPAD concept is growing in acceptance, but it is still far from widely known. The percentage of young people who seek further education after high-school graduation can and should change if we are adequately preparing our youth for the information age. The change will require a commitment to advise all students of opportunities like TPAD programs.

The Portland Area Technical Education Consortium and the Hillsboro Union High School District have made this commitment. Through tools like the *2+2 Counselor Handbook* and *2+2 Tech-Prep Student Guide*, they have increased the visibility and the credibility of TPAD degree programs.

Students, parents, and educators are learning about the vital link being created between high-school technical preparation and two-year associate-degree programs. The goal is to create a familiarity with these programs through repeated exposure—and to advertise that TPAD creates a "win-win" experience for everyone involved.

9

THE EMPLOYER'S ROLE

Connecting Students to the Marketplace

Building an Employer/Education Partnership •

Developing an Effective Mentoring Program •

"A TPAD program . . . offers the opportunities for employers and educators to make significant improvements in communication and cooperation . . . And in the process, everyone will benefit—schools, employers, and students."

Building an Employer/Education Partnership

Carroll Marsalis

For the first time in two decades, our country is feeling the repercussions of a poorly educated work force. Neither vocational nor general academic programs in high schools are doing enough to prepare the average student for the average job. If our country is to thrive or even survive in the new world marketplace, skill deficiencies in the workplace must be eliminated. Employment practices that stress flexibility and mobility must be encouraged. Mismatches between training programs and employer needs must be corrected. And new ways of conducting occupational education, training, and retraining must be devised.

It's time for American educators and employers to wake up to the sophisticated changes that have already taken place and those that are accelerating at an alarming rate in modern industry. We no longer need just blue-collar workers and white-collar workers:

> "Companies need smarter, more flexible employees who can perform a variety of tasks, from installing and monitoring welding robots to reprogramming them if production rates drop. Professor Ernest Lynton at the University of Massachusetts dubs this new breed as "blue-and-white-striped-collar workers"—production employees who are paid to think."[1]

Tech Prep/Associate Degree offers an opportunity for public education to produce this new kind of "striped-collar workers"—workers who possess not only a variety of skills, but also advanced skills, and who are able to reason and operate in both decision-making and production-oriented environments. Applied-academics curricula in TPAD programs build a foundation for the high-level reasoning and operational skills advanced technological manufacturing and production techniques require. In addition, TPAD curricula promise to improve employees' communicative and interpersonal skills, therefore aiding career development.

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[1] Nancy J. Perry, "The New, Improved Vocational School," *Fortune*, 19 June 1989, 127-138.

As high technology is rapidly infused into industry, employers can rely on TPAD programs to help them build a modern work force with more advanced skills, training, and education. Even now, many automated or partially automated manufacturing firms use TPAD curricula to retrain displaced workers so they can operate and troubleshoot technologically sophisticated equipment and solve problems rather than simply perform repetitive assembly-line tasks.

TPAD thus offers employers the promise to help educators close the gap between the skills needs of industry and formal educational offerings. It offers to help employers remain competitive in tomorrow's high-tech, fast-moving economic environment. But this unmistakable benefit for employers comes at a cost—involvement.

United States businesses and industries have a high stake in tomorrow's economy. Their economic success revolves around competitiveness and productivity—both of which depend on an adequately prepared labor force. Now is the time, therefore, for employers to take a more active leadership role in education. And one of the most effective ways employers can involve themselves in education is through active and enthusiastic support of TPAD programs. Successful TPAD programs provide the opportunity—and the challenge—for a *full and effective partnership* between employers and educators.

HOW CAN EMPLOYERS BECOME INVOLVED?

Communication must be a primary element in an effective employer/educator partnership. One reason the present education system is not doing enough to prepare students for today's changing and challenging technology is that employers are failing to communicate to schools what future workers need to know. As a result, students graduate with few or no employable skills, and employers spend approximately forty billion dollars a year to train entry-level employees themselves.

Of course, employers are not the only cause of the communication gap. Members of the business community are too rarely invited to participate significantly in development activities. Too often, they are viewed merely as direct or indirect financial resources, not as partners in the education process.

A TPAD program, however, offers the opportunity for both sides to make significant improvements in communication and cooperation. Educators can do more than teach the general curriculum. Employers can do more than support the schools through annual taxes and various types of monetary contributions which might or might not benefit either party. And in the process, everyone will benefit—schools, employers, and students.

Frequent and thorough communication between employers and educators helps everyone involved. Employers can explain to educators the requirements of their industries and the specific levels and areas of performance they expect from their workers. Together, educators and employers can develop new objectives and competencies for students to achieve in many career areas. By keeping the lines of communication open with the educational community, employers have the opportunity to help build a more competitive work force and to have significant impact on both the educational system and the national economy. Only through a quality work force can America achieve the productivity levels necessary to be competitive in the vastly changing international economy.

Employers can also support TPAD programs at the very front end of development—by taking the lead in *initiating a policy demand* upon the educational system. Of course, support for this type of educational policy should come from all segments of the population, public and private. But employers can be especially effective in helping the community focus on emerging work-force policy issues, such as the need for more employees with more advanced skills than the system presently provides. Through aggressive effort, employers should be making the leaders of the nation, states, local communities, and the educational system aware of current and emerging work-force needs and issues. An excellent opportunity to provide such input is presenting itself across the country today in the name of education reform.

Since the publishing of *A Nation at Risk* in 1983,[2] states and school systems around the country have been struggling with ways to improve the quality of instruction in order to produce a better student. Commissions have been formed, studies have been done, indictments have been made, and some ambitious programs have been undertaken or proposed. However, most of the attention has centered around elementary/secondary (K-12) education and basic-skills issues with little attention to providing the advanced skills employers need. The business community has been asked to participate, but primarily as cheerleaders in an advisory capacity. Two major problems emerge from this situation:

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[2] David P. Gardner et al., *A Nation at Risk: The Imperative for Educational Reform*, report of the National Commission on Excellence in Education (Washington, D.C.: Government Printing Office, 1983).

- Resolving elementary and secondary problems alone will not fix the nation's massive work-force problem.
- Many critical work-force issues are going unattended because members of the business community have not involved themselves or been involved in the "trenches" to see that meaningful programs of study go on line as part of the reform movement.

To resolve these problems and take advantage of the move toward educational reform, employers should help *provide mechanisms* for holding concrete discussions with educational administrators, governing boards, and state and community leaders. Business leaders must become proactive in helping form coalitions which promote debate and influence state educational policies and legislation. These coalitions, which should exist at both the state and local levels, can provide forums for discussing educational reform, student goals, employer needs, and new strategies and initiatives.

At these forums, employers should press for an integrated approach to change in education. Elementary and secondary programs should not be viewed in isolation, but in combination with postsecondary possibilities. Employers also need to address the relevancy of the curriculum as it relates to theory and real-world practice. (TPAD offers practical solutions to both issues, promising both ongoing and relevant education.)

In addition to providing more productive communication and involvement with the educational community, employers can become more active in a number of *educational enhancement efforts* aimed at developing human resources. Many employers have become involved in efforts such as:

- providing or loaning equipment to schools,
- providing space for classes,
- providing student and teacher awards and scholarships,
- releasing personnel to teach in schools,
- participating in adopt-a-school programs,
- serving on advisory committees,
- arranging for student plant tours,
- providing speakers for industry education days, and

- participating in mentoring programs (see the second part of this chapter).

Any or all such activities can provide positive results, and they should certainly be continued. Maximum impact, however, requires a more focused and targeted approach in specific programmatic areas. A good beginning would be to endorse and utilize approaches that have proven successful in past applications as well as in pilot demonstrations. Three of these approaches that have shown the best results are:

- employer involvement in career awareness,
- work-based learning, and
- adult retraining.

Career Awareness

Employers who play an active role in Tech Prep/Associate Degree programs can pique the interest of students and motivate them through helping them become aware of career possibilities and expectations. Taking students beyond the classroom to explore the world of work helps correct preconceived notions, erase misconceptions, and instill practical and realistic ideas about what is expected of them when they finish their education.

Although most employers focus their efforts on high schools, career-activities can be especially effective in the elementary and middle grades. Florida has instituted a program entitled "Blueprint for Career Preparation." At a very early age, children are exposed to information about careers and technological developments and are allowed access to self-awareness programs. By the sixth grade, these students are evaluated in terms of their interests and abilities and counseled on the basis of these evaluations. The process continues through the later grades.

The Florida model is successful for both students and employers because it reinforces basic skills with practical job information. Unquestionably, employers can support a program which integrates strong basic skills with relevant employment examples.

Career-awareness activities can be important tools for promoting TPAD and recruiting students for the program. However, employers have to work to make the career programs they develop or participate in both meaningful and interesting. Industry tours and career days can be meaningful successes or complete failures, depending on the involvement and commitment of the employer and the messages they convey to students. Elizabeth Smith, the coordinator of HOTlink, a community-based organization of regional industry and schools in central Texas, advises employers to focus their presentations toward answering four specific questions:

- What does our particular business or industry do?
- What types of jobs does our business or industry offer?
- What does it take for someone to get one of our jobs?
- What does it take for someone to keep one of our jobs?

In promoting career awareness, employers must be honest with students and be sure they have the information they need to make decisions. This means being clear about the amount of education required for certain jobs and the career ladder that must be climbed to reach a certain position or income level. Students appreciate candor and straightforward information. They are better prepared if they know exactly what they need to do to reach their goals. Having such information, in fact, is crucial in helping them make attainable goals in the first place.

Work-Based Learning

Few would argue that the best entry-level employee is one who has both a good academic background and a certain amount of practical experience. It is difficult, in many cases, to tell which is more important. Certainly academic preparation is important. But both high-school and college graduates often find that lack of experience is a major obstacle in obtaining a job.

The future almost demands a blending of practical and theoretical training in occupational programs. Hands-on experience, coupled with a sound education base, appears to be among the major requirements for newly developing jobs. This holds true for major skill trades as well as manufacturing and service-sector jobs.

The West German apprenticeship model, which has been very successful in Europe, offers some useful ideas on how the blending between education and experience might be structured into an educational system. In the German system, known as the "dual system of vocational education," students combine academic instruction with work-based learning. A sixteen-year-old who has chosen a particular vocational program will sign a contract to become an apprentice in one of a number of trades. The students attend a vocational school one or two days a week and work in the chosen field for the balance of the time. Currently, there are almost two million apprenticeship contracts—representing 57 percent of all West German students—in force in West Germany under this arrangement.

It is unrealistic to believe that this specific apprenticeship model could or even should be copied in the United States. Americans tend to balk at the idea of locking students in to a specific vocation at an early age. They fear that such practical training almost inevitably skimps on academic preparation, thus turning out graduates who are prepared to do only one thing.

These are valid fears and should certainly be addressed in setting up a work-based learning system. Nevertheless, the basic idea of workplace learning is a valuable one that can be adopted and used very effectively in a TPAD program—whether the arrangements between employers and students involve apprenticeships, cooperative programs, or work-study programs. American employers and educators need to rethink their positions on practical training and remember that the best job prospect is the person who possesses *both* theoretical knowledge and practical experience.

Listed below are some suggestions for employers and educators to consider when including work-based learning in a Tech Prep/ Associate Degree program.

1. *Agree on the purpose of the work-based learning program.* This will mean ongoing discussion among employers and educators about the expectations and the needs of all parties concerned. The most effective work-based learning programs are based on the agreement that students should learn from mutually supportive activities in the classroom and workplace—that TPAD programs should combine academic classroom work with current job practices and procedures.

2. *Arrive at a consensus of learning objectives.* A representative committee of employers and educators in each career cluster should discuss, identify, specify, and measure what the students need to learn—both in the classroom and in the workplace. This discussion should provide an opportunity for both employers and the educators to identify job-market needs and make projections.

3. *Set up a reasonable and progressive schedule for work-based learning.* Work programs can begin as early as the ninth or tenth grade. (The exact starting time, of course, depends on the career field and the number of objectives and/or competencies a student must obtain.) In those early years, however, a student should work no more than eight hours per week. In the later high-school years (grades eleven and twelve), a student could work up to but not more than fifteen hours per week. Full-time summer work-based learning should include objectives that cannot be covered during the regular school

year. It is important to remember not to allow the work-based learning to take too much time away from the classroom, where the student needs to receive most of his or her work experience. Still, enough time should be set aside for the job to allow for a comfortable balance between academics and practical experience. Work-based learning should not be confused with student-aid programs or cheap labor for firms.

4. *There should be signed agreements between the student and the employer who provides the work-based learning environment*. A formal agreement helps reinforce the employer's investment into the program and makes sure the student is informed about employer expectations and program objectives.

5. *Award appropriate credit for demonstrated competencies obtained through work-based experiences*. After the student has started his work, both the employer and the educator must come to an agreement on what level of competency the student is expected to achieve and how that competency is to be tested. Credit should be awarded by both school and employer.

6. *Focus expectations appropriately*. Student expectations should be based on career preparation, interest, and ability. Employer expectations should be based on how their efforts will contribute to a better work force. Educators' expectations should be based on the ways that practical work experience can reinforce academic learning.

7. *Stress that work-based-learning arrangements do not necessarily lead to eventual employment at the workplace learning site*. It is important that the employer and the student understand from the beginning that once the apprenticeship is over and the conditions of the agreement fulfilled, the student is free to take employment elsewhere or pursue other educational endeavors. In addition, the employer should not feel obligated to hire the student unless there is already a mutual satisfaction and understanding between the employer and the student.

Adult Retraining

TPAD programs are vital for preparing today's students for tomorrow's workplace. In addition, however, employers and educators are seeing an increasing demand to focus on the needs of groups within the work force, including:

- unskilled workers,
- high-school dropouts,
- traditionally underrepresented population groups,
- illiterate adults, and
- displaced workers.

These adults can use the same curricula as high-school students to prepare for returning to the work force as qualified, highly skilled workers. A few community colleges and vocational-technical schools around the country have been highly successful in conducting TPAD programs for adults. Through applied academics and high-tech courses, these adult workers can be prepared to return to the work force within a few weeks of beginning the program. More important, they are given the foundation they need to adjust to future changes in the workplace. (See chapter 7 for a more detailed description of these programs.)

Employers can make these programs more beneficial for themselves and their employees by becoming actively involved in such retraining programs. Industry representatives can work with teachers to create a useful curriculum that will significantly improve the skills and employability of workers. In some instances, employer representatives will even teach classes. The key to these programs seems to reside in the partnerships and commitments that are displayed between the employers and the educators. The most successful retraining programs are applying TPAD concepts through the use of advanced automated-learning systems.

EMPLOYER/EDUCATOR PARTNERSHIPS: A KEY TO TPAD SUCCESS

America's place in the newly developing world economy depends upon its ability to compete effectively in the marketplace. In the business/industrial community, this competitiveness translates into quality and increased productivity. The demand for better quality and optimum productivity requires changes in the way we develop human capital.

Tech Prep/Associate Degree programs can serve as agents of positive change for the American work force—supplying the kind of skilled employee employers desperately need. Successful TPAD programs, however, require participation and commitment on the part of both the educational and employer communities. Proven TPAD demonstrations illustrate how employers, employees, students, and education can join together in partnership to create programs that make a difference by delivering positive results.

Today's economic conditions demand that employers take a more active role in bridging any gaps between the needs of industry and the ability of the work force to produce. A unique opportunity to close those gaps now exists due to the education reform movement that is sweeping America. Employers must play a major role in all aspects of the reform efforts and support linkages among all levels of education. This can be done in many ways. One of the most important, however, is an emphasis on practical and applied learning as well as academic excellence in the classroom. Well-conceived, proven TPAD programs address these issues and provide a blueprint for business and education partnerships in the future.

Developing an Effective Mentoring Program

Maggie Rice

It has been said that you can't prepare today's students for tomorrow's world using yesterday's methods. However, some of yesterday's methods are just what today's students need. And a mentoring program—an organized system of pairing a TPAD student with an adult who is working in the student's chosen field—is a case in point.

WHO BENEFITS FROM A MENTORING PROGRAM?

Ostensibly, mentoring exists for the student to help him or her make a smooth transition from school to the world of work. And students do benefit immensely from a well-run mentoring program. First, a mentoring program has holding power for students; it provides them with incentives to stay in school and in the TPAD program itself. A number of factors—the rigor of the curriculum, the need to earn money, and the lure of time-shortened options—tempt students to leave TPAD programs. But mentors, by extending the students' support system and clearly showing them the application of what they are learning, can help keep students focused beyond the limited scope of next weekend or next month, toward the goal of completing the program. In addition, by exposing students to a wide variety of jobs and job situations, mentoring helps students decide ahead of time whether their chosen career path is really suitable for them.

Students aren't the only ones who benefit from a mentoring program, however. The benefits extend to the educational institutions as well. Retention of students in the program helps it grow quickly and develop a track record, which in turn attracts other students. Second, the contact between industry and education personnel that goes with a mentoring program helps keep both teachers and curricula up-to-date. Third, the commitment by business and industry to vocational-technical students who will be the workers of tomorrow also commits employers to the importance of vocational-technical education today. Last, mentoring programs eventually benefit themselves: today's protégés are very likely become tomorrow's mentors.

Employers also benefit from their help in keeping the TPAD curriculum current and from providing the mentors needed by the programs. First, graduates of mentoring programs are likely to be well-trained and highly motivated job applicants—just the kind of employees businesses and industries want and need. Second, employers save money because they no longer must bear the cost of extensive training of new employees. Third, mentoring gives industry a chance to prescreen potential employees by getting to know them in high school.

Clearly, a mentoring program is more than a "win-win" experience; it offers "win-win-win" possibilities. Students, schools, and employers all stand to gain from a well-organized, efficiently implemented system of mentoring.

DESIGNING AND RUNNING A TPAD PROGRAM

Probably those best-qualified to design and run a mentoring program are the consortium members who have been working on the TPAD curriculum itself. Ideally, this should include representatives of business and industry, professional and trade associations, and secondary and postsecondary institutions; such a mix will help ensure a broad perspective. Because of their involvement in the TPAD process, these individuals understand the overall purpose of the program. They appreciate the rigor of the curriculum and can understand the potential of pairing students with industry workers. The business members of the consortium are especially suited to design a program because their involvement in the TPAD development process has given them a sense of ownership. They have a stake in the results and, since they represent top and middle management, they can see to it that the mentoring design is put into practice by their respective organizations.

The actual process of designing a mentoring program begins by asking questions. The driving question is:

- What should be the goals of the mentoring program?

Other questions are:

- How can mentoring be made to benefit students, school personnel, and business and industry?
- What activities will foster these goals?
- At what grade level or point in the program should certain learning experiences be scheduled?

Questions such as these allow consortium members to begin brainstorming ideas. The brainstorming session(s) could be scheduled for one of the regular quarterly meetings of the TPAD consortium. Such a meeting of the Leander (Texas) Independent School District/Austin Community College 2+2 Instrumentation and Control Consortium yielded a long list of ideas, which was mailed to the individual members for further reaction and input. To ensure student readiness for the activities, the list was then examined by educators most familiar with the TPAD course content. Finally, the edited list was adapted into a proposed mentoring program and presented at the consortium's next meeting for suggestions and approval.

One caveat needs to be spoken to anyone wishing to start a mentoring program: Start small and build. Make sure the proposed activities are capable of being implemented and that there are sufficient mentors for potential protégés. Remember, the success of the first class of students will pave the way for the future of the program. Other activities can always be added and additional companies involved once a firm foundation has been laid. But a program that crumbles under its own weight in the beginning will be difficult to reconstruct.

Someone, perhaps a counselor or administrator at either the secondary or postsecondary institution, will need to serve as coordinator for the mentoring project. The coordinator oversees day-to-day operation of the program and checks with selected mentors and students from time to time to make sure suggested activities are being carried out. A list of mentors and protégés involved in the program will be kept in the coordinator's office.

Budget is always a consideration in designing a mentoring program. Even the best-designed and most efficient program will involve certain costs:

- stipends for speakers, trainers, mentors and teachers;
- bills for supplies and services such as postage, typing, telephone, printing, training materials, brochures; and
- miscellaneous charges for site visits, travel for speakers, refreshments for meetings, and so on.

Early discussion of these items and how they will be paid for allows the parties who will be responsible for them to include them in the budgeting process.

CHOOSING AND TRAINING MENTORS

Selecting the right individuals to be mentors is critical to the success of a mentoring program. Successful mentors have certain personal characteristics in common; program coordinators and protégés all testify to the importance of these characteristics:

- maturity,
- self-confidence,
- patience,
- willingness to work hard,
- a caring and supportive attitude,
- honesty,
- ability to motivate others,
- high expectations for themselves and others, and
- a belief in young people.

Beyond choosing potential mentors with the right personal characteristics, program coordinators should consider other factors. First, mentors should be volunteers. The mentoring role requires extra time and effort, and often the only reward is the intangible positive feeling that comes from guiding and helping others. (Though the relationship can benefit mentors by helping fight staleness and burnout, there are no guarantees.) Second, mentors should possess excellent communication skills, and they must be as good at listening as they are at expressing ideas. Finally, mentors must value equally the role of formal education and the role of hands-on experience in training someone for the job market. They must be as diligent in encouraging their protégés' schoolwork as they are in encouraging the cocurricular activities that are part of a mentoring program.

Much thought needs to be given to the mentor-protégé match. Obviously, mentors and protégés are matched for specific occupations, since the goal of TPAD mentoring is career awareness and job experience. Additionally, it is best if mentor and protégé can be matched by:

- gender,
- ethnic background, and/or
- interests.

Such an additional match may be critical in retaining students, building their comfort and confidence, and giving them the type of role model that helps them see their own potential.

Mentor training should begin with an explanation of the purposes of the program. Mentors should thoroughly review the goals, objectives, and proposed activities of the mentoring program. They should also understand how varied their role(s) and responsibilities may be. Mentors may be called on to serve as role models, guides, advisers, tutors, observers, encouragers, prodders, or any combination of these.

Another important part of mentor training is helping mentors understand the ways they can contribute to students' lives. One way to do this is to give the mentors a chance to think back and identify mentors—both formal and informal—in their own lives. This exercise can help impress upon mentors what they have to offer to their protégés, including:

- an opportunity to apply "book learning" to real-life situations,
- the safety to test new skills and ideas,
- the encouragement to take risks,
- insight into real-world circumstances,
- an understanding of the importance of communication skills,
- an understanding of the work ethic,
- an appreciation of the role of continued education as the only defense against obsolescence,
- a realization of the importance of teamwork, and
- an understanding of the informal and formal "rules of the game."

Learning how to make these contributions, therefore, makes up a large part of a mentor's training.

Finally, a mentor's training should address problems that could arise in the mentor-protégé relationship:

- Some mentors have trouble setting a pace that matches a student's needs. Working too slowly leads to boredom, but pushing too fast can be frustrating.
- Some mentors have trouble accepting the growing ability and maturity of protégés; they have trouble letting protégés "fly."
- Some mentors run into difficulties when professional or personal demands change dramatically, leaving insufficient time for mentoring.
- Some relationships just don't gel; under these circumstances a student can feel rejected.
- Even relationships that do work out may result in a student's feeling rejected when the program is over.

- In addition, not every protégé will enter the career field of the mentor upon completion of the TPAD program. Some may not finish the program; some will change occupations completely; others may aspire to four-year degrees. In any of these cases, mentors may face their own feelings of rejection.

Mentors should be trained to seek help whenever such difficulties arise. If the problems prove too big, the student may need to be assigned to a different mentor. Most problems, however, can be resolved through perseverance and good communication. Mentors should be assured of the continuing support of the program designers and administrators, of the educational institutions, and of the employer.

HOW SHOULD THE MENTORING PROGRAM BE EVALUATED?

Mentor-protégé relationships may last many years and involve activities which span long periods of time. However, questions about the success of individual activities and about the program itself cannot be postponed until the student finishes the program and the formal relationship has been culminated. Ideally, the program should undergo a summative evaluation on a yearly basis, with many midcourse mini-evaluations. The mentoring program coordinator will oversee evaluation activities.

After each activity, such as training or orientation, and at year's end, anonymous evaluations should be completed by all participants—mentors, protégés, educators, program coordinators, and business and industry representatives. Evaluations should address issues such as:

- To what extent were the goals and objectives clear?
- What have been the accomplishments of the program?
- Were the activities appropriate to the needs of participants?
- How can the program be improved?
- Should the goals be changed or modified?

From this feedback, future plans for the mentoring program can be made.

One important fact to remember is that, objective data to the contrary, no program is successful unless the participants perceive it to be so. Therefore, as much energy needs to be expended in addressing the *perceptions* of all the participants as is expended in scheduling, designing, and refining future activities and events.

A SUGGESTED MENTORING-PLAN TIMETABLE

The mentoring-plan activities listed below evolved quite naturally as part of other activities in the Leander ISD/Austin Community College TPAD program. Certain activities are suggested for each grade level in years one through four of a 2+2 program.

Before TPAD (Sophomore Year in High School)

During the grade in which students choose the TPAD major (in the case of a 2+2 program, this would be the tenth grade), the students' potential for success in the program is gauged by employing a career/interest inventory. If necessary, remediation or upgrading will begin in mathematics and reading.

If parents have not already been informed about TPAD, they are brought into the decision-making process at this point. A letter is mailed to each student's parent(s) to explain the program's requirements (course outline, grading system, etc.) and career options. A parents' orientation night about TPAD is also held. Each student is counseled individually.

During this preparatory year, new students are "adopted" by high-school seniors who are already in the program. The senior students serve as mentors to new juniors as part of "the buddy system" for support and friendship.

First Year of TPAD (Junior Year in High School)

At the beginning of the first TPAD year, a back-to-school party is held for adult mentors and students. (Mentors have already been assigned and mentors and students have exchanged information sheets about each other before the event.) The back-to-school party constitutes the mentor-protégé training session, but it is disguised as a social activity. During the party, students are "matched" with their mentors. An orientation presentation explains the mentoring system and spells out what is expected of each participant. Then each mentor-protégé team completes an action contract. Mentors should follow up this activity with a letter and a phone call (which will allow further discussions of the contract). As an evaluation technique, the mentoring project coordinator will follow up this activity with phone calls to selected individuals.

Throughout this novice year, mentors should reinforce the importance of learning academic basics—reading, writing, mathematics, science—as well as the importance of keeping up in first-year TPAD work. They should emphasize good study habits.

Mentors and students participate in other activities as well during the first year. Mentors serve as guest lecturers to the program's classes in the fall. Students visit at least two industries on a group field trip in the spring, and mentors tour the school to learn about its total program. If possible, individual visits are planned; mentors visit the school to eat lunch and attend classes with their students in the fall, and students visit the mentors at the work site in the spring.

Toward the end of the spring semester, students and mentors complete an anonymous evaluation form and mail it to the mentoring project coordinator (so that the process can improve as it evolves). Then first-year students and their mentors are invited to a spring "Dutch treat" banquet sponsored by the public school district and the community college.

Summer Between Junior and Senior Years of High School

During the summers, the teachers in the TPAD program should have an opportunity to meet with mentors from industry, do some shadowing at industry sites, obtain a summer job in a technical occupation, and/or attend teacher training. Students may complete some kind of "summer project" for presentation in the fall when they return to school.

Second Year of TPAD (Senior Year in High School)

Another back-to-school party is held in September. Mentors and protégés complete another action contract, and mentors again write letters to their protégés and discuss the contract in a follow-up phone call. The mentoring program coordinator follows up this activity with phone calls to selected individuals to evaluate the effectiveness of this activity.

During this second TPAD year, mentors should emphasize the need for top-notch study habits to prepare for college-level work. Mentors also begin to groom their protégés for the world of work, discussing such topics as ethics, punctuality, and so forth in scheduled phone conversations and/or on-site visits. If possible, mentors visit the school one day in the fall, eating lunch in the school cafeteria and going through classes with the student. Students visit the job site in the spring and are given the opportunity to interview various technicians on the job.

If possible, the mentors visit the school to assist students with their "career passport" preparation. (In the Leander ISD, students have been using a computer program during their high-school years to enter data that can produce a computer-generated resume.) This allows mentors and protégés time to reflect on accomplishments to date.

During this or the previous year, mentors may want to consider asking their companies to offer tuition reimbursement, part-time work, or scholarship opportunities for which their protégés might apply.

At the end of the year, secondary and postsecondary seniors host a "Dutch treat" banquet for staff, advisory-committee members, TPAD students in both institutions, parents, and mentors. This provides an opportunity to recognize outstanding mentors, students, and others. At this banquet, college freshmen adopt high school seniors who plan to enter college as freshmen the following year.

The counseling department assesses each student's skills during the spring semester. If remediation in any area of mathematics is in order, such activity should begin—if at all possible—in the summer before the student begins the college curriculum.

Toward the end of the year, protégés and mentors again complete an anonymous evaluation that can be used to assess program effectiveness and make necessary improvements. Also during this time, a listing of available summer jobs at advanced-technology industries should be made available to all students. These need not be technician jobs. Any job will give the student insight into the world of work.

Summer Between High School and College

Activities similar to the previous summer are encouraged for both the mentors and students. If possible, this would be an excellent time to employ students in jobs that would at least allow them to talk with technicians on a day-to-day basis. Those students who need remediation in mathematics or reading should be counseled to obtain tutoring during the summer.

Third Year of TPAD (First Year in College)

In the fall, the technical, community, or junior college hosts a get-together for TPAD students (and their "significant others"), mentors, advisory-board members, and faculty. This event features an orientation about what to expect at college. It also serves as a mentor-protégé training session for the postsecondary portion of the mentoring program. Once again, students and mentors complete an action plan for the year, and mentors follow up with a letter and a phone call. Once again, the mentoring coordinator checks on this activity with phone calls to selected individuals.

As indicated above, first-year college students are "adopted" on the buddy system by college sophomores. These student mentors help first-year students adjust to the community-college climate.

During the fall of the first college year, students go on structured field trips to work sites connected with their field of study. During these trips, students should have the opportunity not only to view equipment, plants, and facilities, but also to speak to workers and ask questions.

Many community-college students must work in order to finance their education. If possible, therefore, students should be allowed to interview for any available part-time jobs in advanced-technology industries. Mentors may want to assist the students in this endeavor by providing all students in the program with a listing of available employment opportunities. Mentors also serve as adjunct faculty by appearing as guest speakers and serving as resource personnel.

Students at this point in the program again attend the spring "Dutch treat" banquet at the end of the year. This is the time to honor people for jobs well done, to announce job and scholarship opportunities, and to anticipate highlights of the next year's program.

Summer Between Freshman and Sophomore Years

During this summer, every effort should be made to get each student into a summer internship program with an advanced-technology industry. Again, mentors may want to consider asking their companies to allow students to apply for tuition reimbursement or scholarships. Teachers should be encouraged to do some job "shadowing" or acquire summer jobs as technicians to remain at state-of-the-art capability.

Fourth Year of TPAD (Second Year in College)

Attendance at the annual back-to-school party is by now routine for mentors and protégés at this level. Each team will complete the mentor-protégé action contract for the year. The mentors' follow-up letters and phone calls should include congratulations for making the "senior year" of the program. Letters to high-school teachers and parents are also appropriate. As usual, the mentoring process coordinator will follow-up this activity with phone calls to selected individuals.

During this year, mentors and students should arrange to meet informally as much as possible. By this time, the relationship should have evolved into a comfortable one that needs less structured activity. Students will be preparing for job interviews, and mentors can assist in this task by providing encouragement and advice.

During their last year in the TPAD program, students should participate as much as possible in professional activities. Teachers and students should attend a professional conference. If possible, mentors should encourage students to attend a professional conference with them. Also, student membership in professional organizations should be arranged.

As in the previous year, mentors will serve as adjunct faculty and/or resource persons, and mentors may want to ask their companies to allow students to apply for tuition reimbursement.

At the end of the year, mentors and protégés will fill out anonymous evaluation forms and return them to the mentoring coordinator. Mentors, students, advisory-committee members and all other interested parties will attend the "Dutch treat" spring banquet. Those students who have already obtained employment in the field should be recognized, along with others who have made outstanding accomplishments. Those students who have elected to pursue four-year degrees may get scholarships. If so, these should be announced. Eventually, it would be a good idea to invite outstanding graduates of the program to be guest speakers at this event.

General Activities Not Designated For a Particular Year of the Program

- Mentors invite protégés to special events their companies hold such as picnics or award ceremonies.
- Mentors talk with their protégés about trade magazines, publications, news items.
- When asked to, mentors can help tutor protégés.
- Mentors and protégés could work together on a technical project.
- Mentor can meet and talk with the protégé's parents.
- Mentors should make a point of celebrating their protégés' successes.
- Mentors and protégés can meet to discuss changes in the profession.

- Mentors can help protégés get a clearer picture of the job market by arranging for the students to interview a series of various workers about their jobs, asking questions such as:
  - — What is the job?
  - — How varied is the job?
  - — Is the worker part of a team?
  - — What are the educational requirements of the job?
  - — What is the work environment like?
  - — What are the advantages and disadvantages of the job?
  - — What is the potential for professional growth? Earnings? Benefits?
  - — What is the philosophy of the company?

MENTORING: MAKING A DIFFERENCE FOR THE FUTURE

The importance of mentors in a total TPAD program cannot be overestimated. Indeed, those individuals who have been fortunate enough to have mentors in their own lives will affirm the difference the mentor-protégé relationships made in their attitudes, skills, behavior, and choices. What cannot be affirmed, but merely inferred, is the difference mentoring *could have made* in the lives of countless others. Certainly the loss to both American industry and individual Americans from a lack of organized mentoring programs must be profound. One can only hope that the current generation of tomorrow's workers will be luckier as increasing numbers of educational programs incorporate organized mentoring programs into their curricula.

10

HOW DO YOU FEEL ABOUT TPAD?

A Forum of Satisfactions and Concerns

- A Community-College President's Perspective
- A Public-School Superintendent's Perspective
- A Community-College Administrator's Perspective
- A Vocational-Technical School Director's Perspective
- A Public-School Administrator's Perspective
- A Community-College Faculty Member's Perspective
- A Public-School Faculty Member's Perspective
- A Counselor's Perspective
- A TPAD Coordinator's Perspective

"Students come back to work after class. They ask questions both in and out of class. They talk to other students about their classwork. Their self-esteem improves, and they gain confidence in their abilities."

Introduction

Forming and operating a TPAD consortium means participating in a significant educational reform at the grassroots level. The process of changing curricula, changing the teaching and learning process, changing parents' expectations, redirecting students, listening and responding to employers, and changing attitudes is a highly interdependent one. It involves cooperation, enthusiasm, communication, and "buy-in" by people from many sectors of education, employment, and community. And every one of those people come away from TPAD with a story to tell.

Throughout this book we have emphasized the process and people issues that go along with establishing and maintaining in a TPAD consortium. This chapter attempts to recast these issues in the first person—to allow those who have participated in TPAD programs to share their predispositions, experiences, and perspectives. We asked each of the following contributors to represent his or her role in the process. This chapter, therefore, describes how TPAD looks through the eyes of a:

- community-college president,
- public-school superintendent,
- high-school principal,
- college dean of instruction,
- area vocational-technical school director,
- college faculty member,
- high-school teacher,
- counselor, and
- TPAD coordinator.

Specifically, we asked each of our contributors to include in his or her selection the answers to the following questions:

- What do you think are the major benefits of TPAD—for your institution, for you personally, for others?
- What problems and issues have you and your institution encountered as you worked to make TPAD a reality?
- What are some of your concerns for the future of TPAD?

Not all of the contributions addressed these three items in that order, and we did not try to force them into a uniform format. In fact, we didn't always agree with what they said—but finding people who agree with us was not the point of this chapter. We wanted honest opinions and practical observations, and that is what we got. We hope you will find them as valuable as we do. And as you read, we hope you will be able to:

- glean some fellow-traveler's tips for working effectively in your own role,
- understand better the concerns and responsibilities of those in other positions, and
- gain a better sense of how "it all works together."

We're sure that you'll discover, as we did, that the person who seemed to have the most fun with TPAD, and derive the most satisfaction, was the high-school teacher. We think that's significant, because teachers are on the front line of TPAD. They are the ones who observe firsthand the difference TPAD makes in the lives of students. The apparent reason for this teacher's enthusiasm was witnessing the renewed enthusiasm, confidence, and purpose in some "forgotten students." And those students, after all, are the reason for instituting TPAD in the first place!

A Community-College President's Perspective

Bill Segura

Who benefits from a Tech Prep/Associate Degree program? Students are the primary beneficiaries. Tech-prep offerings have the potential to break down the elitist notion that only the select group of prebaccalaureate students is worthy of attention. When properly designed and delivered, the TPAD approach can strengthen a student's appreciation for both the utility and the power and elegance of the arts and sciences. Put simply, a well-operated TPAD program should help high-school students:

- derive greater enjoyment from the learning process,
- experience success in the classroom,
- stay in school, and then
- move into a postsecondary educational program without having to repeat much of the course work they completed in the last two years of high school.

When they have completed their TPAD work, they enjoy the benefit of having the skills they need to find work or to seek further education.

But students are not the only ones who benefit from TPAD programs. These programs benefit the community by helping reduce the high-school dropout rate and by producing high-school and community-college graduates who are more technically confident and therefore better thinkers, problem solvers, and communicators. In addition, there is a subtle benefit which promises to have profound impact on the future economy and quality of life within our communities. Technology permeates virtually every aspect of our lives, making us increasingly dependent upon our technicians. As teachers, students, and communities begin to experience the payoffs from TPAD programs, TPAD offerings will begin to be seen as the "courses of choice" for an increasing number of students rather than as an alternative to the traditional curriculum. In the future, I predict, not only will we have the technicians we need to keep our communities running effectively and our problems well in hand; but we will also regard our technicians more highly.

The introduction of the TPAD concept pays still other dividends that are generally unseen by students and the community. As high-school and community-college teachers sit down to struggle with the challenge of bringing continuity and applicability to the curriculum, they soon realize that instruction methods must change in order for the TPAD concept to work. Teacher-centered methodologies, which tend to rely heavily on lecture and demonstration, must give way to more collaborative and interactive methods, which require that the teacher be as much a facilitator as an authority. Team teaching, sometimes called for because of the multidisciplinary nature of some parts of the TPAD curriculum, calls for different attitudes and methods as well. Through the process of initiating and sustaining a TPAD curriculum, therefore, community-college and high-school faculty are compelled to rethink the purpose as well as the process of teaching and learning.

POTENTIAL TPAD PROBLEMS

One of the central problems associated with the establishment and even the ongoing maintenance of a Tech-Prep/Associate Degree program is the problem of ownership. To whom does the program belong? The college? The high school?

It is imperative that neither the high school nor the high-school curriculum be seen as in distress and that community colleges not be seen as the "white knights" who are coming to the rescue. The Tech-Prep/Associate Degree concept can only succeed when it is created and sustained as a part of a true partnership between the high school and the community college. Both schools must acknowledge that they have a joint interest in the same students and a common belief that a more tightly linked, application-oriented curriculum will better serve those students.

Another set of issues which must be faced early in the establishment of a TPAD program are those associated with the cost of curriculum review and revision. Faculties of both the high school and the college are typically on academic-year contracts with full teaching loads. For this reason, making it possible for key faculty members to sit down with their counterparts to conduct the initial business of program design becomes a real challenge. Both the college and the high school must be ready to shift resources from other purposes or to find new resources to provide for substitute teachers and/or to bring teachers back to school during vacation periods.

Perhaps the most nagging category of problems associated with TPAD ventures is that of public relations. People in many different positions may struggle with misunderstandings and misapprehensions about the program.

People in the community, for example, may ask questions such as:

- "If this is college-level work . . . do we need the last two years of high school?" or
- "So, what happens when these kids finish high school? Do they go on to the community college and take the same things over again?"

College and high-school personnel may raise the same kinds of redundancy questions while becoming increasingly concerned about the security of their jobs. High-school students may wonder whether the TPAD option constitutes something really new or whether it is a mere "dressing up" of the old curriculum—and whether it will be any more inspiring, any more or less difficult. Finally, the four-year colleges and universities may be concerned about whether the college credits earned by high-school students in tech-prep programs reflect true college-level work. Furthermore, they may be given to suspect that the community college is simply trying to boost its own enrollment by building a stronger association with young people while they are still in high school.

In dealing with any of these issues, it is essential that community-college and high-school officials:

- tell the same story, without contradicting one another or exaggerating the role of either institution,
- not understate the revolutionary aspects of the TPAD venture, and
- stress the benefits to students and to the community without overstating them.

Community, teacher, parent, and student understanding of and trust in the program are so critical that schools should be careful to take the time necessary to build a healthy level of support for the concept before proceeding.

FUTURE CONCERNS FOR TPAD PROGRAMS

As with any innovative practice, the initial stages of a TPAD program are marked by a period of great enthusiasm and attention.

Over time, however, what once was new can come to be taken for granted. In the case of a Tech Prep\Associate Degree program, care should be taken to see that the curriculum not only is up-to-date and viable, but also that a close linkage between the high-school curriculum and that of the community college is maintained. To do so will probably require periodic meetings between the faculties of both institutions, as well as ongoing curriculum revision. While this effort will cost considerably less than development and startup, there will be a cost nonetheless.

Of even greater concern is the potential for the TPAD program to be put on hold or eliminated altogether. Another characteristic of new programs is that they have a tendency to appear as an "add on" to the basic curriculum. A program such as TPAD, therefore, may be seen as expendable when school budgets become tight, or it may be seen as experimental and therefore a likely candidate to be replaced during the next wave of educational reform.

Yet another reason a TPAD program can be eliminated is that it has been too closely associated with a key administrator or teacher. When that prime mover leaves or is reassigned, there could then be a loss of enthusiasm and direction for the program.

The potential problem of tenuousness argues once again for a broad sharing of the ownership for these vital programs. Tech Prep/Associate Degree programs truly present a win-win experience for everyone, but everyone must remain involved if the TPAD program is to work.

A Public-School Superintendent's Perspective

J. Frank Yeager

As a public-school superintendent and former professor of education administration, I have read many reports dealing with school reform. And I have been greatly concerned that most of these reports and the follow-up actions they have triggered do not adequately address one of our most serious educational problems: a dearth of educational options that prepare non-baccalaureate-bound students adequately for today's complex and demanding job market. My awareness of this instructional void as it exists in my home community of Owensboro, Kentucky, led me to believe we must reexamine our secondary curricula and reorder our priorities. The success of our efforts in this regard, particularly the institution of tech prep at the high-school level, has been encouraging, although development of a full TPAD program in our area is not yet a reality.

In Owensboro, since the 1987-88 school year, we have introduced vocational exploratory classes that employ personal computers to help seventh- and eighth-grade students investigate career possibilities. In addition, students and their parents receive careful and frequent counseling concerning the students' aspirations and expectations. This is done so that a student's choice of a specific diploma program can be better informed.

At the high-school level, Applied Mathematics and Applied Communication have been introduced for general-diploma students; Principles of Technology I and II are offered with the cooperation of the Owensboro Vocational/Technical School. (This arrangement, which involves a release-time program supported by the staffs of the two institutions, evolved after considerable dialogue and involvement.)

As I write, we are in the process of redesigning our industrial-arts area of instruction at the middle- and high-school levels to make it more relevant to today's job market. In the near future, we plan to examine the total vocational-education program offered at the middle- and high-school levels with an eye to the same goal.

Obviously, an undertaking of this scope requires the commitment of the Board of Education for the development of supportive policy. Applied courses are now required by policy as part of our general-diploma instructional program.

Part of the focus of our tech-prep efforts has been one on developing a good work ethic among our students. Without the combination of a saleable skill and a good work ethic, success in the workplace is not likely.

The tech-prep program has filled a need within the school district by taking some of our more capable general-diploma students and teaching them applied technology skills. Hopefully, the second year of the tech-prep program will take the process farther. We anticipate additional offerings will be developed at both the state-operated postsecondary vocational/technical schools and our local community college which builds upon the tech-prep courses.

Owensboro schools have yet to develop a functional continuum of technical programs from secondary to postsecondary schools. I believe that developing such an agenda is crucial to meeting the needs of the vast majority of our students and preparing them for the workplace. While some tech-prep programs prepare some students to enter the work force directly from high school, most require further education and/or training. To me it seems clear that the most efficient way to provide that training is through a combined secondary and postsecondary effort.

Because of the unique governance structure of the secondary and postsecondary educational institutions in Kentucky, past attempts at cooperation between educational institutions have been fragmented and disjointed. In fact, prior to the cooperative effort leading to the tech-prep initiative in Owensboro, the respective players in this community did little cooperative planning. If joint planning does not continue, or continuous-technology program opportunities are not developed beyond the high school level, I do not believe our public school effort to date will produce satisfactory results. Public schools (secondary education) cannot do the job alone.

With the recent establishment of a new state cabinet-level department (Work Force Cabinet) in Kentucky, and with the relocation of Kentucky's vocational/technical schools within this new emphasis on the world of work, I am basically optimistic about the future of TPAD in Kentucky. We can—and, I hope, will—do much more to meet the educational need of the majority of our students.

A Community-College Administrator's Perspective

Elbert Marcom

When Austin Community College, where I serve as dean of vocational-technical education, first began considering a Tech Prep/Associate Degree model, our overriding interest was to provide a more effective and efficient educational program for our primary clients—our students and the employers who hire them. We could see several clear advantages that this model offered, and other advantages became evident as planning progressed.

We were eager to develop closer relationships with our "feeder" high schools, and we saw that the special relationship developed through the integrated curriculum might result in a steady supply of well-prepared students entering the postsecondary phase of the program. We felt that the close coordination of curriculum between the institutions might make the transition from high school to community college easier. The program seemed to fit our desire to provide opportunities in technical career preparation for those of the "neglected majority" who might have interests and aptitude in math and science and to help us expand instructional efforts in the "high tech" areas to fill the needs of local employers better.

As planning proceeded, we could see that the TPAD project also offered potential relief to the college's perennial "too much content and too little time" dilemma. That dilemma arises from the need to squeeze emerging "advanced technology" topics into the already packed two-year associate-degree format. And we found that moving certain basic or foundational courses into the high-school curriculum helped relieve the crunch.

In the joint electronics curriculum developed between ACC and the Leander Independent School District, for example, we learned that placing the foundational electronics courses in the first two years of the TPAD curriculum permits inclusions of three additional specialized courses during the final two years. Thus the student in the "2+2" program has the opportunity either to complete the standard electronics curriculum early or to stay the normal two years and complete course work in an instrumentation and control specialization.

We had several anxieties as implementation of the program began:

- Would enough students enroll in the high-school courses to justify the program?
- How would tech-prep high-school graduates be accepted into the postsecondary electronics program?
- Would tech-prep high-school completers be able to function alongside electronics students who had taken their basic courses at ACC?
- Would the ACC instructors view the Leander students as being adequately prepared?
- Would employers support the joint program?
- Would ACC electronics instructors support awarding credit for the courses taken in high school?
- Would administrators at both levels give sustained support for the several years necessary to implement the program fully?

Because our program has been implemented slowly as students have "grown" through it, some of these questions have yet to be answered. Several important patterns have emerged, however. Large numbers of secondary students have enrolled in Principles of Technology I, amply demonstrating the appeal of presenting a traditionally "difficult" subject (physics) in an applied manner. The quick acceptance of this course is doubly impressive because it does not yet count as a science credit toward graduation in Texas schools. Far fewer students have enrolled in Principles of Technology II or in either of the two electronics courses offered at the secondary level. But secondary students in both the Principles of Technology and the electronics courses have proven much better able to master the technical core content than some of us had expected.

Fewer high school graduates have continued into the postsecondary program than we initially expected. This has not proved to be a problem because the TPAD choice is a modification within the larger ongoing postsecondary electronics program, which has continued to serve its regular constituents and therefore does not depend completely on TPAD students. But the relatively small number of tech-prep students who choose the associate-degree path does suggest a need for the college to have earlier, stronger, and more frequent contact (recruiting, if you prefer!) with secondary TPAD students.

Our experience with the Tech Prep/Associate Degree program to date has been very rewarding, particularly in the partnership developed with the Leander School District. We are eager to strengthen and augment the current program and move into some new ones. Possible future developments include:

- finding ways to begin student orientation and exploration of the program much earlier, possibly in late elementary years,
- developing "mentoring" programs of secondary students with counterpart postsecondary students and/or technicians in industry,
- including cooperative work experience in industry, perhaps during the summer months when school schedules are not so tight, and
- broadening opportunities for students at the postsecondary level (in courses such as quality assurance, telecommunications technology, etc.) which would build on the common core of skills and courses already taught at the secondary level.

We are moving to expand TPAD efforts in two ways—first, by involving more secondary schools in our established electronics project and, second, by initiating efforts in other disciplines that can use the same basic framework.

The Tech Prep/Associate Degree idea has received considerable attention in Texas over the last couple of years. It is highly encouraged in the Texas Master Plan for Vocational Education. It is noted as a key strategy in Texas's recent statutory mandate for regional planning in vocational education. More recently, of course, TPAD was included as a funded program in the revised Carl Perkins federal vocational legislation.

Given this external support and our own positive experience, we are more than ever convinced of the validity of TPAD programs, and we look forward to helping develop them further.

A Vocational-Technical School Director's Perspective

Tara Parker

Tech Prep/Associate Degree can break down the barriers which sometimes separate high schools, vocational-technical schools, and community colleges. TPAD also helps eliminate program duplications that cost students time and money. Add to this the fact that TPAD supplies industry with better-trained workers, and the bottom line is that everyone involved is a "winner."

When the Owensboro Campus of Kentucky Tech, vocational-technical school, first became involved with TPAD, the primary emphasis was on applied academics. As earlier chapters show, this is not just a skills program or just a theoretical program, but a blend of the two. It is based on the assumption that instruction in an applied setting can reach some students in a way that traditional programs cannot. TPAD curricula can be applied in many different work situations, but can also make general education more relevant by building the student interdisciplinary skills.

Our basic TPAD goal was to develop and implement a joint exemplary planning project that would:

- increase the area's technically trained work force in response to business and industry needs;
- integrate academic and vocational course offerings so that students could learn and utilize technical skills while applying academic concepts; and
- increase the number of secondary students enrolled in advanced vocational classes that would qualify and prepare the students for employment after high-school graduation.

Of course, certain obstacles stand in the way of any effort to implement something new or different, and the TPAD project was no exception. The first and most obvious is the tendency toward "turf" protection. To combat this, we made sure persons from all participating educational institutions were involved in the planning stages of the project.

Another obstacle raised was concern over whether TPAD might pull teachers and students away from other programs such as college prep. This is definitely not the intent, since TPAD is designed for students who have made no commitment to pursue four-year degrees after high school.

Parents and other educators may need to be convinced that TPAD is a genuinely challenging and productive program, not an academic dead-end or a program for "have nots." The easiest way to handle this issue is to involve employers as well as educators in communicating the rationale behind TPAD: to prepare students better for jobs or for continuing education.

The most time-consuming logistics problem is coordinating schedules and credits between secondary and postsecondary schools. Both participating institutions must keep communication lines open and be willing to "give and take" on issues such as where each course is to be offered.

Time itself can become an obstacle if insufficient time is allowed to develop an articulated program. TPAD development takes time and effort on the part of every affiliate. The project cannot be completed in just a few weeks or months, or even in a year. And the work continues even after the complete program is in place. The program must be reviewed and refined on a continuing basis. Faculty commitment must be reinforced. Joint faculty workshops, promotion of TPAD concepts to educators, and public-relations efforts with students, parents, and the community as a whole must continue.

Despite the possible problems involved in creating a TPAD program, the results are worth it. In just its first year, our involvement in TPAD has produced many benefits:

- High-school enrollment in vocational classes has increased because of applied-academics programs such as Principles of Technology.
- The Owensboro Independent School District has integrated early career counseling and applied academics into its general course of study.
- The program helps increase the quality and number of high-school students entering postsecondary technical-education programs.
- Students are better motivated to learn because they know they must achieve certain competencies before they can move on to higher-level courses.

- The work of articulating courses and programs enhances relationships and communication among the faculties and administrators at the various participating schools.

Tech Prep is a winning proposition. I believe, in fact, that the only losers are those who elect to ignore or write off this exciting new educational concept.

My main concern about TPAD in the future is that it continue to move forward and make necessary changes to ensure that the curriculum remains relevant and the program itself does not stagnate. Once the program has begun and some success has been realized, the natural tendency is to sit back and admire our work. However, the changing nature of the technical workplace which prompted the development of TPAD is the very reason such programs cannot remain static. TPAD has proven to employers that educators can be responsive to industry needs. But just as the workers of the future must be able to change and adapt to a changing workplace, so must we in education develop the ability to adapt our methods and our programs to changing needs. In other words, instituting TPAD is just a beginning. Beginning a TPAD program means laying the foundation for a dynamic curriculum that will be updated and improved continuously . . . or at least annually.

As TPAD programs grow and change, the players on the TPAD team will be changing as well. When a teacher retires or an industry representative is transferred to another state, we must continue to train and recruit new players for the team. We in Owensboro have already learned firsthand that such losses can be very frustrating. We must remember, however, that the team *should* change. "Dynamic" and "ever changing" are the concepts on which TPAD is based. With team-member turnover should come renewed enthusiasm, new experience, and new ideas. At the same time, new team members—even those at the CEO level—must be oriented in TPAD concepts and motivated with TPAD success stories in order to involve them as quickly and thoroughly as possible.

In addition, we need to expand the types of specialty areas from which a student can choose after having completed the technical core curriculum. Some technical-education programs lend themselves better to this approach than others, but students from all vocational, technical, or college-preparatory programs of study can benefit from TPAD and applied academics. It should not be reserved for just those students in the technical certification areas. The applied approach to math, English, physics, and biology/chemistry can benefit all students, even those adults who are continuing their education after employment or career displacement.

Industry and education partnerships have emerged as a result of the need to respond to rapidly changing technology. But these partnerships must be enhanced and expanded if we are to keep pace or even dream of being "on the cutting edge" of future technology training. I hope that other vocational administrators feel as I do that TPAD is the way for us in vocational and technical training areas to continue providing industry with well-qualified workers, while articulating our curricula more effectively with the high schools and community colleges.

A Public-School Administrator's Perspective

Charles Rouse

We in the United States are currently in an economic war. And one of the crucial factors in our nation's ability to compete in the world marketplace is the quality of our work force—especially our technical work force. Since it is estimated that as much as 50 percent of the skills, knowledge and requirements that make up a technical specialty will change every three to four years, it has become imperative that we train our technicians in such a way that they are able to change with the industry. Industry wants technicians who have a broad base of knowledge and can be further trained for specific jobs, rather than students prepared for a single, specific occupation in high school or college.

Tech-prep programs, with their basis in applied academics and their pathway into postsecondary technical programs, provide just such a firm but flexible foundation. But instituting a successful tech-prep program in a high school involves breaking down some barriers and meeting certain challenges.

The first hurdle, in my experience, is getting the right students into the program. Tech prep is targeted at the "neglected majority," those students who, though capable of doing postsecondary work and acquiring advanced skills, tend to be unfocused in their high-school course work and to seek unskilled employment directly after graduation. Often these students must be sold on the program as a personally viable option because they tend to traipse along the path of least resistance unless required to make a commitment.

Other potential TPAD students hesitate about choosing the tech-prep option because they or their parents believe that everyone who wants to be successful must attend a university after high school. Universities are not for everyone; vocational-technical schools and community colleges represent the best option for many. So the question of how to convince students that TPAD is a good route for them remains an issue.

In addition, the perception of applied-academics courses as "watered down" must be dispelled. State education departments who resist giving academic credit for these courses perpetuate this mistaken perception. Applied-academics courses such as Principles of Technology are fully as rigorous as—or more rigorous than—"regular courses"; they are simply taught in a way that many students find easier to learn. Research in learning styles indicates that many of our students learn and retain more through a multisensory applied approach which emphasizes practical knowledge which is applied immediately.

Another possible barrier to success is waning interest and commitment among area employers. Employers who seem eager to participate during the planning and development stages, even to the point of financial commitment, may become less enthusiastic when asked later to provide on-site training, whether paid or unpaid.

All of these developmental barriers—difficulties in persuading students to choose TPAD, misperceptions about courses, and lagging employer interest—can loom large for educators who are trying to get a TPAD program moving. Fortunately, none of these difficulties is insurmountable, as the success of operant TPAD programs across the nation proves.

Offering tech-prep programs within a high-school setting offers numerous benefits, moreover. Upon graduation, participants in the program are better prepared for entry-level employment, vocational-technical school, or community-college work than students who simply take the general curriculum. Tech-prep programs keep some students in school who would otherwise drop out. And industry reaps the benefits of a better-prepared, more stable work force.

An undeniable fact of life in today's economy is that industry needs technicians. With that fact in mind, it is easy to see that tech-prep programs belong in high schools, where one of our goals is to graduate useful, productive people with marketable skills. Tech-prep programs truly represent a "win-win" situation for the majority of high-school students. You need only talk to a few graduates from our program to get excited about what such a program can offer.

A Community-College Faculty Member's Perspective

Cecil Phillips

The development of a TPAD partnership accomplishes several things, all of which are important to college faculty:

- It improves the quality of the instruction that students receive.
- It increases the number of options available to students either through education or through work.
- It makes the transition from one level of instruction to another easier for students, while also providing a coordinated, comprehensive curriculum built upon business and industry input.

Despite these benefits, TPAD programs are not always welcomed with open arms at postsecondary institutions. At the onset, as well as during the planning and development, of the TPAD program, the postsecondary faculty may express several concerns.

The first concern commonly expressed is that the secondary student, because of either immaturity or inadequate secondary instruction, may not be prepared for postsecondary-level instruction. Other concerns will arise in the area of "turf" protection; faculty may fight against losing current courses in favor of new tech-prep offerings. Some faculty members may worry that employers involved in developing TPAD will be allowed to dictate teaching methods and/or course content, and some will simply resist change of any kind. Concern will most likely be expressed over the time it takes to properly develop and implement a new program and the fact that faculty are typically expected to develop and implement new programs without sufficient time allowed for full research and evaluation. Finally, certain faculty members will wonder about the financial aspects of the program's development. Financial concerns will range from the money needed to release teachers for curriculum development to the funds required to purchase needed equipment or supplies for the classroom.

Time will be required for these concerns to be addressed and a new TPAD program to be brought into being. At least two years should be allotted for full planning and development of a such a program.

The first step—the planning phase—will take approximately six months. This time is needed for the formation of committees consisting of both secondary and postsecondary faculty, guidance personnel, and representatives from local business and industry. These committees and a steering committee which oversees their work will be key to the successful implementation of the program. It is through their involvement in the planning process and their "buying in" to the TPAD concept that the concerns noted above can be put to rest. Each committee may need to meet several times before they develop the requisite understanding of each other's needs, strengths, problems, and abilities. Once these different groups have come to an understanding and have developed respect for each other, they can concentrate on the task assigned to them. Establishment of goals, objectives, strategies, and timelines for project development and implementation is more easily accomplished when the committees work as a team.

The remaining eighteen months allowed for TPAD development will be taken up in actual curriculum development, recruitment of students, and inservice training for faculty. Here again, a steering committee made up of both employers and educators can be helpful in the implementation process. It can help devise a recruitment plan for students and a method for reviewing, evaluating, and revising the program at regular intervals.

Some changes in or additions to the postsecondary curriculum may be necessary prior to implementation of the new program. At our own college, for example, the existing Electronics Technology program was modified to become a "Master Technician" program called Electronics/Electromechanical Technology. To do this, new courses (Statics/Strength of Materials, Dynamics, Basic Fluid Mechanics, and Computer Programming for Technologists) had to be developed in the mechanical areas, with a few new electronics courses (Principles of Lasers and Fiber Optics, Principles and Application of Robotics, and Electromechanical Systems) added as well.

We quickly found the the benefits of the new Master Technician program far outweighed the inconvenience of making the necessary revisions. The primary benefit was that it allowed the college to develop a four-year, coordinated, comprhensive TPAD program in Electromechanical Technology—a program for which local industry had expressed a need. Beginning the basic electronics courses in high school and requiring students to take Algebra I and II, geometry, technical drafting, and Principles of Technology as prerequisites provided a solid base for the development of the postsecondary-level courses. As a result, more students are currently taking math, science, and technical courses at the high school. Additionally, employers have become more involved in both the high-school and community-college programs because they have "ownership" in the TPAD efforts.

The difference in students coming to the college from the TPAD program is significant. A typical tech-prep graduate exhibits higher expectations than his or her general-diploma counterpart. (This can be attributed in part to the involvement of business and industry not only in the planning and development of the program, but in the recruitment of students as well. Students have heard directly from business and industry about the types of jobs that await individuals completing the program.) Tech-prep graduates also tend to be better equipped in math and science. They project a more positive attitude about the overall learning process. And they tend to have a better sense of direction in where they are and where they wish to go, exhibiting a confidence in their ability to accomplish their goals.

To achieve full benefits of a TPAD program, the involvement of all key personnel in the planning, development, and implementation phases of the program is imperative. In particular, involvement of guidance personnel is paramount to the program's success. These individuals are empowered to share or withhold information on the program with potential TPAD students. They cannot and will not recruit students into a program with which they are not familiar. Also, because student recruitment can make or break a program, parents should not be forgotten. Parents have a powerful influence over their high-school offsprings' decisions. It is important that they know as much about the program as the student does—or more.

Finally, it is important for the postsecondary faculty and administrators to enter into the program with eyes wide open but hopes high. They must realize that reaping the rewards of a TPAD program takes time and be prepared to suffer through low enrollment during the early years of the program's development. But they can also be confident that, with proper planning, involvement of all key personnel, careful development, and timely implementation, TPAD success waits just around the corner.

A Public-School Teacher's Perspective

Harriet Palmer

Tech prep was not a term that meant much to me a few years ago. My first introduction to tech prep was through the applied-physics course, Principles of Technology. I was told that a new physics course was going to be added to the curriculum and that I would have to attend a three-week workshop in the southern part of the state (South Carolina) to help me prepare to teach it. Although less than thrilled about spending three weeks of my summer vacation this way, I did attend the workshop. And my experience there—along with my later experience teaching this new course and the TPAD program it is part of—changed my attitude dramatically.

Why do I like TPAD? This is a program where students can succeed and get excited about their successes. The hands-on approach and the everyday applications of courses like PT make the concepts relevant to the students. Many students have parents who work in technical fields. When these students see that their parents' work relates to what they themselves are doing in school, they begin to understand the need to know and the need to learn. The TPAD classes are fun. They are challenging. And TPAD students find they can learn without the drudgery that many associate with education.

Another thing I and many of my fellow teachers like about TPAD is the different teaching style that is used in this curriculum. This is a hands-on, "think about it" type of program. Students work individually on some projects, but on other projects they are encouraged to work together and share ideas. Students quickly learn that PT lab activities are joint projects, and that sometimes, just as in the real world, the activities do not go as planned. Students are encouraged to share ideas about how to make the labs work better (or at all!), and they draw their own conclusions from what they have done. They learn to share responsibility and to cooperate with each other—to work in teams.

This may sound like an idealistic or unrealistic picture. I, too, was skeptical about it at first. But I have found that all of these things do happen—and more. Students come back to work after class. They ask questions both in and out of class. They talk to other students about their PT work. Their self-esteem improves, and they gain confidence in their abilities. The main reason I love TPAD is that courses such as PT do such wonderful things for students.

How does a TPAD program get started? Interest in tech prep is essential, but interest is not enough. You must have some action to get the program going.

Our area of South Carolina is fortunate to have the Partnership for Academic and Career Education (PACE) housed nearby at Tri-County Technical College in Pendleton. PACE helped get TPAD off the ground by educating teachers and administrators to the great need for technically trained workers in today's job market. This piqued the interest of educators, especially those who did not have a technical background and who therefore were unaware of the career opportunities available to students entering the job market.

Our school's direct involvement with TPAD began when our principal attended a tech-prep workshop and came back with some ideas that he shared with the English department chairman. They, along with the PACE coordinator, planned implementation of the program in the English department. The Department Chair adapted the Applied Communication materials to our curriculum, with the freshmen doing three modules per year, and the other classes doing four modules per year. The science department next became involved with Principles of Technology through our vocational department, and the math department launched one class, Tech Prep Math III (with plans to add Tech Prep Math I and II the following year).

The push from PACE was essential to get our TPAD program off the ground. Faculty members had talked among themselves for quite some time about implementing such a program, but no one really had the resources or the time to get the groundwork done. This is where PACE came in. They gave us direction and suggested goals that were appropriate to our school system. They involved the counselors and tech-prep teachers in determining what would be the best direction for our school and our students. They printed pamphlets and curriculum guides for students and gave tremendous support and encouragement. It is fair to say we would never have gotten off the ground without them.[1]

Finally, with four key factors in place—

- interested administrators,
- interested teachers,
- interested guidance counselors, and
- a support staff (PACE)—

tech prep was on its way at Pendleton High School.

I have to admit that student motivation, the different teaching style, and the practical applications were all influencing factors in my getting involved in tech prep, but I would be less that honest if I did not mention another key factor: a twenty-five-thousand-dollar grant to be used for PT equipment. My PT students use equipment that I only looked at in college.

Not every tech-prep class will use equipment such as oscilloscopes, function generators, and multimeters, but they will perform activities that require their complete involvement. In courses like PT, students are participants, not just disinterested onlookers. And because of this involvement, they begin to see some direction in their journey through the curriculum. They no longer just drift through general courses to complete unit requirements. Instead, they begin thinking about the need to prepare for postsecondary life, whether that involve technical school, a university, or the work place.

Not everybody, of course, will be sold on TPAD from the beginning. As with any new program, certain concerns of staff, parents, and students must be addressed.

Teachers, for example, may resist the program—especially the applied-academics part—because it is different. They would rather maintain the status quo because it feels comfortable and secure. Because a new program introduces unknowns, there is also a fear factor in teacher resistance. This is not an unreasonable fear, just one that has to be overcome.

Tech-prep workshops and conferences provide one good way to alleviate teacher concerns. These workshops, which usually include "testimonials" about TPAD from other teachers, are great anxiety relievers and also fun learning experiences. They help replace frightening unknowns with solid information. Inservice programs also promote acceptance by acquainting teachers with tech-prep concepts

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1. Editor's note: In many instances, the TPAD coordinator can perform the same function for a TPAD consortium that PACE played for this school in South Carolina.

and familiarizing them with what goes on in applied-academics classes. With time, patience, and a little effort on the part of TPAD developers and teachers themselves, familiarity with TPAD will eventually lead to better faculty acceptance.

The high-school guidance department may also have initial problems with understanding and accepting TPAD—and these problems can slow or cripple effective implementation of the program. Counselors represent the "front line" for steering the right students into various educational options. Unfortunately, new courses that are not considered part of the college-preparatory program—including applied-academics programs such as PT, Applied Communication, or Math for the Technologies—tend to be used by counselors as "dumping grounds" for those students who cannot be put anywhere else.

The solution to the problem of counselor resistance lies in educating the guidance department. Counselors should be invited to look at the tech-prep curriculum and be informed about its goals. They, too, should be included in workshops and inservices. Once they understand and appreciate the TPAD program, they often become its valuable allies.

At Pendleton High, we are fortunate to have a guidance department that is aware and supportive of the tech-prep concept. One of our counselors even serves on the PACE counseling committee. Our students, therefore, receive the benefits of informed and realistic counseling, whether they are preparing for a baccalaureate degree, an associate degree, or the work place.

Another major concern that must be addressed is that of community acceptance—or resistance. Often "tech prep" carries a negative connotation for parents, who labor under the misconception that this program will hold their children back or limit their educational options. To combat this notion, parent meetings can be held. (In our area, the PTSA devoted one of their regular meetings to discussion of the tech-prep program.) Pamphlets and curriculum guides can be sent home with students in hope that parents will read them and understand TPAD better.

It is important to emphasize that expectations for tech-prep students are as high as those for college-prep students; only the emphasis is different. In English, for instance, college-prep classes tend to emphasize more abstract concepts and analysis of literature, whereas tech-prep classes address more concrete concerns—teaching students to communicate effectively in the work place. However, students in both curricula must master the same composition skills.

I have found that student enthusiasm over TPAD can go a long way toward alleviating parents' concerns about the program. When students start to show an interest in the tech-prep classes, then parents become excited as well. And students do get excited. This past year, for instance, our area had the first PT contest in the state. Each school was allowed to bring a team of four. In my PT class, I had five students who met the requirements the class had set for team members. Four were chosen through a tie-breaker system we had initiated. But five students, not four, came with me to the contest, which was held early on a bright, beautiful Saturday morning after a school holiday on Friday. The fifth student, an avid fisherman, gave up a fishing trip to come help with the contest because he enjoyed PT so much. This type of interest cannot help but win parents over to the tech-prep program.

In my experience, student enthusiasm over TPAD is contagious and helps overcome any concerns the students themselves may have about the program. Enthusiasm and interest are also generated through outside resources. Employers and instructors from local colleges are usually willing to donate their time to visit schools and talk with students. They discuss everything from conduct in a job interview to the skills and training required for particular jobs and careers. These same people will usually help arrange field trips to their company or college so that students might get a firsthand look at what skills they will need and what will be expected of them. Many students will come back from these trips with interest in areas they had previously ignored or overlooked.

In order to meet student concerns and resistance, a tech-prep program needs to be sold. It can be advertised through hall posters and the school newspaper. Exhibits can be set up in common areas, with currently enrolled TPAD students available to answer questions. Some schools may even want to start a "tech-prep week" featuring speakers, assemblies, and other forms of special promotion. Again, the enthusiasm of teachers and students is often a TPAD program's best PR.

Of course, no school curriculum, no matter how exciting and interesting, is problem-free, and TPAD is no exception. We have not had any major problems with the program itself, but we have encountered a few snafus—enough to develop some words of advice for avoiding trouble.

A major point to remember is to *make sure that you have your textbooks and equipment in place before you try to teach a TPAD course.* When textbooks fail to arrive and lab equipment is ordered only two weeks before school starts, teachers are forced to be more innovative than they ever planned on being! When material and equipment does arrive, it should be properly stored and organized for easy access. Developing a storage-and-retrieval system with a proper place for everything helps the teacher find equipment quickly and keep an up-to-date inventory. Such a system also helps students become familiar with the location of equipment so that they can set up and break down labs more efficiently.

Students should be encouraged to handle the equipment and become familiar with it, but they should also be taught to care for it properly. In addition, sciences and math courses make use of many pieces of equipment that delight students (lasers, transducers, pumps, and so forth); a few may want to "borrow" these new treasures. Students should be reminded that the equipment is for them to use, but that if the equipment disappears or is handled carelessly, the labs will not be possible, and they will lose the benefit of hands-on, active learning.

Another difficulty we have encountered in our TPAD program is convincing younger students (those in the ninth and tenth grades, and even earlier) of the need for technical education. Older students have jobs or have made postsecondary plans, and they realize the skills that they are learning in high school will benefit them. However, the younger students tend to feel that graduation is light years away; they see no need to worry about technical or any other type of education. Efforts to convince these students of the relevance of technical education are being started at our junior-high level. Junior-high guidance counselors have started a career-awareness program that runs the entire school year. Interest inventories, guest speakers, and field trips to various businesses help spark curiosity about the work world and the training needed to function in this world.

If students' interests and needs are met through a successful tech-prep program, everyone benefits. The institution benefits from higher academic achievement both in the traditional college-preparatory program and the vocational and technical emphasis. Students in each area come to appreciate the value of both programs; in fact, a crossover may occur and students can have the opportunity to combine abstract thinking and practical application. The school image in the community improves as it shows an awareness of career and job trends; the school then becomes a leader in preparing students for postsecondary education and the workplace.

Teachers definitely benefit from TPAD because the teaching methods involved enable them to develop closer relationships with students. As they become more aware of students' hopes and aspirations, as well as opportunities that are available to students upon graduation, they can talk to students more realistically about the future. Most importantly, TPAD teachers benefit because their classes enjoy learning.

And that, of course, brings us to the ways that students benefit from TPAD. Students enrolled in tech-prep courses have fun. They find out that physics is not some unknown to be feared; they realize that math is not some abstract manipulation of numbers that creates total confusion; they find that they can communicate through the written word. When students realize all of these things, they feel better about themselves. They develop a confidence that allows them to set and achieve real goals. They no longer have to drift through school with some nebulous thought of "maybe going on to school or maybe working for a while." Instead, they know what they want to do.

Another important benefit of this program for students is the development of interpersonal skills. Students learn to work together, to cooperate with others. They also develop problem-solving skills and critical-thinking skills that are so necessary for anyone living and working in today's world. As a result, students find that they are better prepared not only for postsecondary education and the workplace, but for life in general.

The community will reap the benefits of the TPAD program in many ways. For example, employers will not have to look outside the community or move their operation to find skilled employees. Local community colleges will be able to spend more time teaching advanced skills to entering students rather than having to go back to basics.

Despite its benefits, however, the tech-prep program is not the panacea for all problems in education. Even with tech prep, we still have students who reject any form of education; we still have class clowns and ne'er-do-wells. But this program does reach many students who have not been reached otherwise. Interest is stirred. Clowns are still clowns, but in a directed manner. And ne'er-do-wells become "do-wells." I have seen it happen in my own classroom.

Successful implementation of a TPAD program requires interest and action on the part of administrators, students, parents, and the community. But in order for this program really to work, teachers must be sold on it. Teachers must communicate that this new initiative is exciting, fun, and useful, and that it can help prepare today's young people for satisfying and productive careers. Without that kind of enthusiasm in the classroom, the program will become another dull, boring, idea that sounded good, but didn't work.

The good news is: with proper orientation and training, the kind of enthusiasm I am describing is easy to come by. I love tech prep. If you take the time to get involved, you will love it, too!

A Counselor's Perspective

Sue Shields

Recently the outgoing Oregon State Superintendent of Public Instruction made a public statement to the effect that high-school students should complete their formal studies at the end of the tenth grade and then go on, if necessary, in a European system of education—choosing either a university-bound further education or training and apprenticeship in a specific job field.

At first, I thought, "Where has he been hiding when a lot of us in high schools have been diligently working on tech-prep programs and 2+2 articulation systems with community, technical, or junior colleges?" Then his comments forced some deep thinking on my part. As I talked with my colleagues, I realized that there is much misunderstanding about this subject and about the need to develop an applied-academics curriculum in the modern high school.

I disagree with the state superintendent's statement that the European educational system should be adopted in our country. That system just will not fit in our American culture. But I believe the state school superintendent's remarks hold merit because they motivate us to examine the contemporary high-school program. For many students, the last two years of high school are a waste, preparing the students neither for meaningful career options nor for further education. Too many individuals are wandering aimlessly in the American high-school smorgasbord curriculum. They need more substance and more structure in their school program.

I think the state superintendent is right that our schools need some basic changes in curricula, methods, and general approach. But such reform of the public schools will not be successful until we carefully examine what students study . . . and how they study. *The United States celebrates a diverse population that can be best served by development of a tailor-made American educational program.*

The Tech Prep/Associate Degree program is an example of the kind of educational reform our country needs. This option offers hope that high schools can help all students take the next step of their lives with confidence. It offers many students the structure and direction they need to make the most of their education.

High-school counselors have long been advocates of giving students good curricular direction, but they are limited by current curricular offerings. Few high schools have been successful in offering substantive and structured programs for the two middle quartiles of the typical high-school student body, which TPAD targets specifically.

In past decades, the North Clackamas School District in Oregon has been attempting to provide prescriptive programming to meet this need. Students and parents meet with a counselor early in the students' high-school career to decide what major they should follow; college prep, vocational-technical prep, or general studies. Certainly this system is not perfect and the general-studies program must be drastically changed, but prescriptive programming does provide some goals and raise the level of concern for those involved in the process. Tech Prep/Associate Degree programs can further enhance that process by providing an applied-academics alternative that will not only help students, but also meet the demands of business and industry in a practical and sensible way.

What is good about TPAD programs? Educators in general, and counselors in particular, like these programs for several reason. In the first place, they attract money and attention! School districts and community colleges implementing TPAD programs have been given a morale boost with some additional federal and state dollars and some spotlight attention. This always catches the ever-eager eye of educators. The dual motivation of money and attention, along with an interest in helping community colleges and employers develop a closer relationship with high schools, has helped get these programs "off the ground."

However, there are many other good reasons why counselors and other educators are enthusiastic about the development of TPAD programs:

- TPAD programs provide a good planning tool for counselors to help students find their niche in school and to motivate them to stay in school.
- TPAD programs offer another option for a host of students in prescriptive programming.
- When TPAD programs are instituted, the high-school curriculum is updated and matched with employer needs.

- There are now quite a few successful TPAD programs in operation; this track record adds credibility to the program.
- TPAD instructors at the high-school level enjoy enhanced status and platform by communicating with educators in the same discipline at the community-college level.
- TPAD programs demand that educational planning give attention to career development. Exposure to contemporary careers is a must for high-school students, and TPAD programs help provide that exposure.
- The applied-academics approach that forms the foundation for TPAD programs is good for a large majority of students who learn better when they can visualize and even experience the application of what they are learning.
- TPAD programs are clearly relevant to the students' future; they offer exposure to the working world, skills that are deliberately targeted for today's market, and even real-work experiences.
- TPAD programs can help schools and colleges with their public-relations programs.
- TPAD programs help build student self-esteem by developing measurable competencies in their chosen fields.

Although counselors generally approve of TPAD programs, however, many of us have experienced several areas of concern as we have seen TPAD programs developed and installed in high schools and community colleges. The following issues and concerns may need to be addressed as TPAD programs get off the ground:

- Counselors are often left out of the planning process and suffer from lack of information. Insufficient counselor follow-up or inservice can hinder a counselor's ability to promote the TPAD program or even to understand it.
- Administrators often lack the expertise or interest to develop good TPAD guidance and counseling materials.
- High-school counselors often do not understand the different associate degrees offered in community, technical, and junior colleges. They could do a better job if provided with this information.
- Most counselors have been educated in four-year college programs and are not in touch with community, technical, or junior colleges and their programs. For this reason, counselors tend to college prep/baccalaureate orientation in dealing with their student clients.

- The older counselor population is sometimes inflexible and not open to new ways of thinking about curricular programs for students.
- Counselors often feel overworked due to the high-school paper shuffle (scheduling, writing grants requests, administering award ceremonies and graduations, etc.) and do not look kindly on more of the same.
- Administrators often feel frustrated with counselors and don't know how to help them make changes or how to deal with the innovations.
- Many high-school counselors seem to lack a role definition. And many see themselves more as providers of psychological services than as vocational counselors. While relaxation techniques and stress reduction can be helpful to students, they don't do much to assist students in planning future careers and choosing curricula.
- Counselors often do not know enough about how people learn. Understanding learning styles is essential so that counselors can help students choose curricula and plan careers.
- Counselor training programs at colleges and universities often provide inadequate instruction in vocational-technical guidance and curricula. They likely will be the last organizations to learn about the TPAD program. Newly trained counselors, therefore, are likely to be largely ignorant of TPAD possibilities.
- Vocational-technical programs are generally looked down upon by students, parents, and sometimes faculty. This image must be changed . . . and implementing the TPAD program may be helpful along this line.
- Counselors spend a large percentage of their time with either the college-prep students or the educationally or emotionally handicapped. The "neglected majority" is indeed neglected—and tends not to get the direction they need.
- Four-year colleges and universities often have problems in giving credit for technical-education programs. TPAD programs seem to be in kind of a "no man's land." In order to counsel students responsibly, counselors need to be informed of current policies in granting credit and of any changes in those policies.
- State-prescribed course requirements, along with the local graduation requirements, tend to restrict the flexibility of the high-school curriculum. Counselors must consider all these requirements as well as TPAD needs when counseling students about which courses to choose.

- Many counselors hesitate to talk to students about career decisions. They feel students will have adequate time to make up their minds about a career, so why rush them?
- It is hard to schedule TPAD courses when the student schedules are so full. Little time is left for anything but the basics.
- Continuity in learning has not received much attention from educators at different levels of education. In most parts of the country high-school and college faculty rarely talk with each other about curricular issues.
- Some community-college faculty and leaders seem neither knowledgeable nor enthusiastic about TPAD programs. They offer high-school personnel little encouragement to develop such a program.

In light of all these issues and concerns, here are a few recommendations that might help make TPAD implementation proceed more smoothly:

- Counselors must realize that tech-prep courses are as rigorous and "respectable" as college-prep courses. Applied academics aren't easier; they are just easier for most students to learn. The TPAD program has proven that most students can learn even "difficult" subjects such as physics or math when these subjects are presented in an applied context as they are used in life and work.
- High-school counselors must be actually involved in TPAD advisory committees, whose membership should include a mix of community-college staff, employers, and high-school teachers and counselors.
- Counselors must understand the differences between cooperative programs, advanced credit, advanced placement, and the integrated applied-academics programs called Tech Prep/Associate Degree.
- Counselors must see the structure as well as the substance of the TPAD program to provide effective student guidance.
- More models across the United States are needed so that school districts can examine other exemplary program materials and then develop curricula that fit local needs.
- Employers should sponsor TPAD development workshops for high-school and community-college counselors and teachers.
- High-school counselors need more continuing-education experiences to help them understand the TPAD curriculum, student learning styles, associate-degree offerings, and so on.

They should also have easy access to personnel and curricular materials in community colleges.

- TPAD field trips to work sites might also help motivate students and faculty.

In summary, high-school counselors who want to help more students be more successful in their schooling experiences should be enthusiastic about TPAD and the new applied-academics approaches in education. The TPAD program provides more opportunities and incentives for more students, as well as an up-to-date curriculum. Best of all, it establishes some relationship between the school curriculum and the real world. The time is right for the Tech Prep/Associate Degree program to become an integral part of the guidance and counseling program in most high schools. In order for this to happen, however, counselors need to be open-minded toward curriculum paths other than the college prep/associate degree option. They also need to be afforded opportunity to understand the content and benefits of TPAD and to participate fully in the TPAD development team. Once this happens, counselors can do their part toward making this win-win strategy an established part of the new American educational system.

A TPAD Coordinator's Perspective

Ed Henderson

Implementation, maintenance, and coordination of the articulated education program for Greenville, South Carolina, is a huge undertaking. Over two dozen programs are articulated between a fifty-thousand-student school district (Greenville County School District) and a large, multicampus two-year college (Greenville Technical College). The school district is divided into four areas, each of which operates much like an individual school district. Four secondary career (vocational education) centers, fourteen high schools, and sixteen middle schools are involved directly in articulation. Seven institutional divisions as well as support personnel at the college participate in articulation.

Keeping track of articulation at all these entities involves the work of a variety of school-district and college staff, as well as volunteers from business and industry. It is my responsibility as full-time articulation coordinator to support and direct this combined effort. A full-time secretary assists me in this work.

Having such a small articulation staff—just the two of us—has encouraged us to make optimum use of existing human resources at both institutions. When possible, articulation duties are transferred to and carried out by existing district and college staff. For example, the four directors of our secondary career centers have as part of their job description the responsibility to maintain articulation programs. Similarly, elementary-school counselors have a documented responsibility for career education.

The responsibilities and qualifications of an articulation coordinator and staff will vary depending on the situation—especially on whether the coordinator primarily represents the college, public schools, or a consortium. My own job description lists two major job activities:

- initiating and coordinating articulation between similar secondary and postsecondary vocational-education programs, and
- developing and implementing articulated, performance-based curriculum guides at the secondary level.

(This latter responsibility is necessary to promote standardization among similar secondary vocational programs).

Within the scope of this broad outline, my primary duties include:

- *researching and, as appropriate, applying current articulation trends,* outstanding coordinated-curriculum programs, curriculum-development theories, and other relevant issues and information to the school district and college;
- *overseeing and supporting committees*—planning, organizing, actualizing, and controlling the work of articulation task-force committees to accomplish identified objectives;
- *assisting in curriculum development*—helping to plan and organize the content and methods of selected vocational programs in order to achieve articulation-program objectives;
- *diagnosing present and projected needs* of employers, educators, and students in order to develop relevant articulated curricula;
- *providing leadership* in modifying existing vocational programs into articulated, performance-based programs.

In addition to these broad responsibilities, I am charged with a number of smaller duties involving support and coordination of various articulation-program committees, including the Executive Committee.

The skills required for this position are similar to those of any program administrator: the ability to set and reach goals, provide leadership, facilitate group interaction, understand organizational structures, and so on. I have found that my administrative experience at both the secondary and postsecondary schools has helped me appreciate differences between the two educational levels and to facilitate cooperation between them. Obviously, specific knowledge about articulated systems, competency-based education, or other related theories and practices is helpful to this positon, but this kind of knowledge can be always be learned on the job.

Selecting and retaining a highly competent clerical support person has been vital to our articulation effort. Besides having up-to-date office skills, the program secretary needs to be able to:

- communicate by telephone with educational and business executives,

- coordinate luncheon meetings and workshops efficiently,
- cope with considerable technical terminology, and
- present a professional image for both the college and public schools.

The positions of articulation coordinator and program secretary are not considered permanent, although they have been in place for ten years. Once the articulation program is considered completely established (or should funding dry up before that time), these positions will be phased out. At that point, articulation will be maintained as a regular activity of instructors and administrators of the public schools and college. For this reason, we regularly analyze our articulation activities to identify which ones can be integrated, without too much of a burden, into the daily jobs of teachers, principals, department heads, deans, and others.

As in any well-planned organization, our articulation-program activities are extensively planned and goal-directed. Program objectives and operations primarily are framed within a fiscal-year operation, and key objectives are partially determined by our budget. Obviously, every attempt is made to accomplish as much as possible within the available time and budget. We continually work to develop a situation where articulation can be continued smoothly by the schools and college departments without specialized coordination.

An Executive Committee guides and evaluates our articulation process. Members of this committee include:

- the college president, and district superintendent, and their chief instructional officers,
- the principals of the four secondary career centers,
- representatives from the State Board of Technical and Comprehensive Education, the State Department of Education, and the State Council on Vocational and Technical Education (on an ad hoc basis), and
- teacher and parent representatives.

Our annual plan is approved by key college and district officials and a school-district planning committee.

In addition to the Executive Committee, various committees are implemented as needed to support articulation efforts and then phased out when no longer needed. (We have found that enlisting the help of existing committees of the cooperating institutions better utilizes available human resources and helps integrate articulation into established operations.) A career-awareness committee, for example, helps integrate a concern for articulation into the public-school guidance program for grades K-12. Employer representatives are involved on existing secondary and postsecondary curriculum advisory committees and school-improvement councils. Instructor task-force committees initially developed articulated curriculum guides and now support the established articulation process. Through committee participation, college and district instructors maintain regular telephone and personal contact with one another, share technical information and resources, share facilities, and serve on each other's advisory committees. Where practical, joint curriculum advisory committees have been created.

The articulation program develops and prints a series of "career awareness" folders for students, teachers, and parents. This literature:

- informs students, beginning at the eighth-grade level, about vocational and technical education options and technical careers,
- encourages them to select strong academic courses in high school and to consider occupational programs of study, especially tech-prep programs,
- urges them to develop independent learning skills and cognitive skills such as problem solving,
- attempts to improve the image of vocational and technical education,
- encourages students to consider higher education—especially technical associate-degree programs, but also baccalaureate and graduate-level work.

The goal of all these efforts is to encourage more students to pursue higher education at all levels and to be prepared to compete in a high-tech society.

To help promote articulation internally and externally, we use a speaker's bureau consisting of industry executives and administrators from the college and the school district's career centers. The goal of the speaker's bureau is to promote technical education and employment opportunities to parent-teacher associations, student groups, teachers and counselors, and community groups. Presentations are limited to twenty minutes and include a narrated slide presentation or video.

Since the beginning of our articulation program, employer participants have helped to define curriculum needs, evaluate graduate performance, and encourage implementation of TPAD education. Our articulated curriculum guides, in addition to helping coordinate programs between the public schools and college, reflect employer expectations for entering employees.

Initially, we piloted our TPAD articulation efforts in the career center, high schools, and middle schools of one of our four school-district areas. In the pilot phase, we limited articulation to several occupational programs so that we could identify the best ways to expand articulation to a number of program and schools. From the beginning, our TPAD efforts rested on the foundation of a time-shortened articulation process and a joint career-awareness effort. By the time we were ready to expand our TPAD efforts, we already had established communications, trust, and coordination between a variety of personnel at the school district and college. "Industry needs assessment" studies by the school district and college had clearly indicated the need for TPAD education. Employer and community support for the program had already had been established.

The fact that TPAD in Greenville County was initiated and has been operated jointly by the school district and college has contributed considerably to our success. *A successful TPAD program cannot be imposed by one institution on the other; it must be run as a partnership.*

During ten years of operation, our program has developed three different Policy and Procedures Guides to help keep administrators and instructors focused on program objectives. These guides have identified potential barriers to articulation and included recommendations for enhancing the articulation process. Many of these recommendations have since been incorporated into the policies and activities of both institutions. At this point, in fact, articulation has become an integral part of the educational services of the school district and college. However, integrating articulation into daily activities at the institutions remains an ongoing challenge that sometimes involves helping change attitudes and established practices.

Our articulation program has encountered some of the typical barriers that can be expected to stand in the way of any change. These barriers have not slowed our progress, however. In the early days of the articulation process, we identified potential barriers and developed strategies for overcoming them. Involving all articulation participants in planning, implementing, and evaluating has contributed to our success, especially our ability to handle roadblocks.

I try to maintain regular contact with key institutional participants through a monthly newsletter, committee meetings, staff briefings, memos, and personal contact. Since articulation is only one of the variety of instructional services conducted by the school district and the college, I try to maintain contact with minimum interference in workday routines. I would advise others involved in initiating or managing articulation programs to recognize that each institution, school, or department probably has an established agendum. The challenge will be to integrate articulation efforts into that agendum with the least amount of disruption possible.

Our program operates on a limited budget. The bulk of our articulation program budget goes for salaries. Major program expenses have included printing TPAD literature for students, producing modest audiovisual materials, printing and distributing our newsletter, and hosting committee meetings. Early in our program, we paid stipends for teachers to meet after school hours and during the summer to coordinate curricula.

Although the Greenville articulation program started with a small federal grant, it has been continued through joint funding by the two-year college and by Chapter 2 Block Grant monies obtained through the school district. Career-awareness efforts, marketing, and other support activities have benefited from grants obtained through the college.

In the past, we have not aggressively pursued joint grant opportunities, basically because the school district phased out its grants office shortly after the articulation program was launched and limited its grant involvements. The school district now has a grants office again, and the district and college are actively exploring joint grant opportunities to support TPAD articulation, math and science instruction at several grade levels, and career-education activities.

Our articulation-program activities have provided many benefits for students and for the institutions involved, including:

- development of articulated competency-based education (CBE) curriculum guides,
- improved understanding and communication between secondary and postsecondary instructors and administrators,
- improved instructional delivery,
- increased careers awareness among students,
- an increase in the numbers and the quality of students entering postsecondary vocational and technical-education programs,
- an improved image for vocational and technical education,
- more articulation credit at the two-year college for high-school vocational-program graduates, and
- more graduates employed in high-tech occupations.

Such tangible benefits have helped sell the articulation program and have made our efforts to integrate into the ongoing programs of the district and the college much easier. From the beginning of our articulation program, participants have recognized that attitudes about education and educational practices would not change overnight—that our goals would have to be long-term. We are gratified by our success in reaching those long-term goals.

Our articulation program still has work ahead of it, of course. In particular, we face the ongoing challenge of "selling" TPAD to potential students and their parents. But we take great satisfaction in observing the benefits of our past work. Seeing TPAD articulation integrated into our school services and hearing of the successes of our TPAD graduates assure us that our efforts have been worthwhile and encourage us to continue our articulation efforts.

APPENDICES

Appendix A: Curriculum Models for TPAD •

Appendix B: Facts About Applied Academics •

Appendix C: Using Applied Academics to Improve General and Vocational Education in the High School •

Appendix D: TPAD Resources •

Appendix A

Curriculum Models for TPAD

An ideal way to design a curriculum and a sequence of courses for a TPAD program is to use a competency-based approach based on a job analysis and task listings. Many techniques for curriculum design are available and acceptable, but all should begin with employer input to the question, "What do your technicians need to know and do in order to perform satisfactorily in their current jobs and to be able to move up their career ladder?"

Several suggestions may prove helpful.

- The program advisory committee or "panel of experts" used as a resource to develop the task listing should consist primarily of second-level managers in the technical field who are potential employers of the future TPAD program graduates.
- Jobs and curricula from a number of related specialty areas should be grouped in "clusters," and the curricula should be sequenced so that they can form a common core of courses similar to the concept presented in the Advanced-Technology Curriculum Structure in chapter 2, figure 2.
- Curriculum models of courses should be developed in a structure similar to the models shown on the even-numbered pages of this appendix. Each course title should represent a logical arrangement of teaching/learning objectives.
- A selection of courses should be made for the high-school portion of the TPAD curriculum. Nearly all of these courses should be in the common core of the cluster. Employers should verify that the high-school portion of the TPAD program would provide a person with entry-level, employable skills and knowledge, in case the completer of the high-school TPAD component does not continue as a full-time student at the technical, community, or junior college.
- The courses should be laid out in a sequence, as shown in figures on the odd-numbered pages of this appendix. These programs of study should reflect high-school graduation requirements and postsecondary associate-degree requirements. It also should be structured so as to develop the foundation (basic applied-academic) courses in the ninth and tenth years and continue with technical courses that build on the foundation.
- The postsecondary curriculum of a TPAD program should conclude with advanced-skills courses that were not accessible in two years of postsecondary work prior to TPAD.

- Listings for any course that will be collectively taught should identify clearly both who (what institution) teaches the course and where the course (lab) is to be taught.

The curriculum models for technologies provided in this appendix are based on job analysis/task listings prepared by the Center for Occupational Research and Development in specific projects. They are not intended to serve as "canned" curricula that can be inserted into any TPAD program; rather, they are a suggested starting point from which courses should be modified according to the peculiar needs of the schools, employers, communities, and students.

ELECTRONICS/COMPUTER TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Digital Fundamentals and Circuits
- Digital Devices and Techniques
- Analog Devices and Systems
- Microprocessors
- Computer Languages and Programming
- Digital Computers / Interfacing

TECHNICAL CORE

- Electricity / Electronics
- Circuit Analysis
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Industrial Processes
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Electronics/Digital Computer Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication				Technical Communications			
SCIENCE	Applied Biology/Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Computer Lang. & Programming	Linear ICs & Analog Circuits	Computer Applications	Digital Devices & Techniques
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Analog Devices & Systems	Digital Fund. & Circuits	Microprocessors	Digital Computer/ Interfacing

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

LASER / ELECTRO-OPTICS TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Introduction to Lasers
- Geometrical Optics and Components
- Wave Optics and Components
- Laser Systems and Applications I
- Laser Systems and Applications II
- Laser and Optical Measurements

TECHNICAL CORE

- Electricity / Electronics
- Digital Electronics
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Manufacturing Processes
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Laser/Electro-Optics Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Introduction to Lasers	Linear ICs & Analog Circuits	Computer Applications	Laser Systems & Applications II
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Geom. Optics & Components	Wave Optics & Components	Laser Systems & Applications I	Laser & Optical Measurements

* Fine Arts or Foreign Language, for example

INSTRUMENTATION AND CONTROL TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Fundamentals of Instrumentation and Control
- Process Control Elements
- Control Systems I
- Control Systems II
- Analytical Instrumentation
- Microprocessor-Based Systems

TECHNICAL CORE

- Electricity / Electronics
- Digital Electronics
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Circuit Analysis
- Properties of Materials
- Computer Applications
- Industrial Processes
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Instrumentation and Control Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Fundamentals of Instr. & Control	Linear ICs & Analog Circuits	Computer Applications	Control Systems I
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Analytical Instrumentation	Process Control Elements	Control Systems I	Microprocessor-Based Systems

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

BIOMEDICAL EQUIPMENT MAINTENANCE TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Chemical Analyzers I
- Chemical Analyzers II
- Gas-Flow Detection / Anlyzers
- Diagnostic Recording Instrumentation
- Life-Support Systems
- X-Ray and Nuclear Equipment
- Ancillary Equipment

TECHNICAL CORE

- Electricity / Electronics
- Digital Electronics
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Circuit Analysis
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Biomedical Equipment Maintenance Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		X-Ray & Nuclear Equipment	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Chemical Analyzers I	Linear ICs & Analog Circuits	Computer Applications	Life-Support Systems
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Diag. Recording Instrumentation	Chemical Analyzers II	Gas-Flow Detect./Analyzers	Ancillary Equipment

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

TELECOMMUNICATIONS TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Digital Fundamentals and Circuits
- Digital Devices and Techniques
- Analog Devices and Systems
- RF / Microwave Communications
- Fiber-Optics Communications (Opto-electronics)
- Telecommunications Networks / Equipment

TECHNICAL CORE

- Electricity / Electronics
- Circuit Analysis
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Digital Electronics
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Telecommunications Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Analog Devices & Systems	Linear ICs & Analog Circuits	Computer Applications	Digital Devices & Techniques
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Fiber-Optics Communications	Digital Fund. & Circuits	RF/Microwave Communications	Telecommun. Networks/Equip.

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

ROBOTICS / AUTOMATED SYSTEMS TECHNICIAN

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Fundamentals of Robotics and Automated Sytems
- Automated Systems and Support Components
- Controllers for Robots and Automated Systems
- Robotics / Automated Systems Interfaces
- Robotics / Automated Systems at Work
- Automated Work Cell Integration

TECHNICAL CORE

- Electricity / Electronics
- Industrial Processes
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Digital Electronics
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Analytical Geometry / Precalculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Robotics / Automated Systems Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		Ind. Processes (Fabrication)	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Fundamentals of Robotics & Automated Syst.	Linear ICs & Analog Circuits	Computer Applications	Robotics/ Automated Syst. at Work
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Automated Systems & Support Components	Controllers for Robots & Automated Syst.	Robotics/ Automated Syst. Interfaces	Automated Work Cell Integration

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

INTELLIGENT BUILDING EQUIPMENT MANAGEMENT

Curriculum Model for Two-year Postsecondary Technology Program

SPECIALTY

- Energy Management
- Safety Systems, Codes and Inspections
- Telecommunication Equipment
- Advanced Industrial Electronics
- Heating, Ventilating and Air Conditioning Systems
- Equipment Maintenance Management and Procedures

TECHNICAL CORE

- Electricity / Electronics
- Circuit Analysis
- Active Devices and Circuits
- Industrial Electrical Power and Equipment
- Graphics
- Mechanical Devices and Systems
- Digital Electronics
- Properties of Materials
- Computer Applications
- Instrumentation and Control
- Fluid Power

APPLIED MATH & SCIENCE

- Algebra
- Trigonometry
- Geometry / Precalculus / Calculus
- Technical Physics

COMMUNICATIONS

- Technical Communications
- Computer Basics

SOCIOECONOMIC

- Economics in Technology
- Industrial Relations

4+2 TPAD MODEL: TECHNOLOGY CLUSTER
Intelligent Building Equipment Management Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Geometry or Elective*	Algebra II	Trigonometry	Calculus or Statistics		
ENGLISH	English I, II, and III and Applied Communication (4 units)				Technical Communications			
SCIENCE	Applied Biology / Chem.	Principles of Technology I	Principles of Technology II		Physics for Technicians			
HUMANITIES	Geography, History, and Government (4 units)						Interpersonal/ Ind. Relations	
OTHER	Health / PE	Computer Literacy		Elective*				Economics in Technology
OTHER	Technology Education	Elective*						
TECHNICAL CORE				Technical Graphics (1/2)		X-Ray & Nuclear Equipment	Ind. Electrical Power & Equip.	Instrumentation & Control
TECHNICAL CORE				Electronic Fab. and Testing (1/2)		Properties of Materials	Mechanical & Fluid Devices	Elective #
TECHNICAL SPECIALTY			DC/AC Circuits	Active Devices I	Safety Systems, Codes & Inspections	Linear ICs & Analog Circuits	Computer Applications	Energy Management
TECHNICAL SPECIALTY			Circuit Analysis	Digital Electronics	Heating, Ventilating, & Air Conditioning Systems	Adv. Industrial Electronics	Equipment Maint. Management & Procedures	Telecommunication Equipment

* Fine Arts or Foreign Language, for example
# Introduction to Lasers, for example

4+2 TPAD MODEL: HEALTH CLUSTER
Nursing

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Algebra II					
ENGLISH	English I, II, and III and Applied Communication (4 units)				English I	English II		
SCIENCE	Applied Biology / Chem.	Biology	Principles of Technology I	Chemistry	Anatomy/ Physiology	Anatomy/ Physiology	Microbiology	
HUMANITIES	Geography, History, and Government (4 units)							
OTHER	Health / PE			Psychology	General Psychology	Speech	Human Growth & Development	Principles of Sociology
OTHER								
TECHNICAL CORE	Keyboarding/ Word Proc.	Computer Basics	Intro to Health Careers	Anatomy	Computer	Therapeutic Nutrition	Fundamentals of Physiolog. Chem.	
TECHNICAL CORE								
TECHNICAL SPECIALTY				Health Careers Nursing	Fundamentals of Nursing	Nursing of Adult / Child I	Nursing of Women	Nursing of Adult / Child III
TECHNICAL SPECIALTY				Health Careers Nursing	Fundamentals of Nursing	Nursing of Adult / Child II	Mental Health Nursing	Nursing of Adult / Child IV

4+2 TPAD MODEL: HEALTH CLUSTER
Medical Laboratory Technician

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Algebra II					
ENGLISH	English I, II, and III and Applied Communication (4 units)				English I	English II		
SCIENCE	Applied Biology / Chem.	Biology	Principles of Technology I	Chemistry		Microbiology	Bacteriology	Immuno-hematology
HUMANITIES	Geography, History, and Government (4 units)				Zoology			
OTHER	Health / PE					Speech		
OTHER								
TECHNICAL CORE	Keyboarding/ Word Proc.	Computer Basics	Intro to Health Careers		General Chemistry	Clinical Chemistry I	Clinical Chemistry II	Clinical Chemistry III
TECHNICAL CORE								
TECHNICAL SPECIALTY				Health Careers Med. Lab. Tech.	Medical Technology I	Medical Technology II	Hematology	Medical Mycology
TECHNICAL SPECIALTY				Health Careers Med. Lab. Tech.		Clinical Lab I	Clinical Lab I	Clinical Lab III

4+2 TPAD MODEL: BUSINESS CLUSTER

Accounting

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Algebra II		Business Math			
ENGLISH	English I, II, and III and Applied Communication (4 units)				English I	English II		Speech
SCIENCE	Applied Biology / Chem.	Prinicples of Technology I	Elective					
HUMANITIES	Geography, History, and Government (4 units)							
OTHER	Health / PE			Economics		Psychology	Economics	
OTHER								
TECHNICAL CORE	Keyboarding/ Word Proc.	Computer Basics	Intro to Business	Business Adm. & Management	Office Machines	Business Law	Business & Finance	
TECHNICAL CORE		Technical Systems			Intro. to Business			
TECHNICAL SPECIALTY			Accounting	Intro. to Accounting	Intro. to Accounting	Prinicples of Accounting I	Principles of Accounting II	Prinicples of Accounting III
TECHNICAL SPECIALTY				Accounting	Taxes I	Accounting Applications	Auditing	Taxes II

4+2 TPAD MODEL: BUSINESS CLUSTER
Merchandising

	HIGH SCHOOL				POSTSECONDARY			
SUBJECT	**Freshman**	**Sophomore**	**Junior**	**Senior**	**Freshman A**	**Freshman B**	**Sophomore A**	**Sophomore B**
MATH	Applied Math I	Applied Math II	Algebra II		Business Math			
ENGLISH	English I, II, and III and Applied Communication (4 units)				English I	English II	Speech	
SCIENCE	Applied Biology / Chem.	Prinicples of Technology I	Elective					
HUMANITIES	Geography, History, and Government (4 units)							
OTHER	Health / PE			Economics		Psychology	Economics	
OTHER								
TECHNICAL CORE	Keyboarding/ Word Proc.	Computer Basics	Intro. to Business	Business Adm. & Management	Intro. to Business	Business Machines	Credit Procedures	Institution & Philosophies
TECHNICAL CORE		Technical Systems				Prinicples of Accounting	Accounting Applications	Small Business Management
TECHNICAL SPECIALTY				Business Adm. & Management	Sales	Principles of Marketing	Fashion Merchandising	Visual Merchandising
TECHNICAL SPECIALTY			General Merch./ Marketing	General Merch/ Marketing		Retailing	Intro. to Buying	Advertising

Appendix B

Facts about Applied-Academics Programs[1]

PRINCIPLES OF TECHNOLOGY

What Is Principles of Technology?

Principles of Technology is a high-school course in applied physics for students pursuing technical careers. It is a two-year curriculum covering fourteen units in applied physics. It should be taught to TPAD students beginning in the tenth grade.

Seven units are taught in the first year, and seven more are taught in the second year. Each unit shows how an important concept in physics—such as force—can be analyzed and applied to equipment and devices in mechanical, fluid, electrical, and thermal energy systems.

Materials developed and tested for *Principles of Technology* include student texts, videocassettes, classroom demonstrations, mathematics labs, hands-on labs, and tests. A teacher's guide for each unit provides suggested presentation strategies, information about how to perform classroom demonstrations, and additional information for problem-solving labs.

Principles of Technology was designed to:

- increase the employability of vocational students;
- emphasize principles rather than specifics of technology and provide an understanding of the mathematics associated with these principles;
- increase the appeal of instruction by using an interest-holding instructional system incorporating:
  - — video presentations,
  - — demonstrations,
  - — hands-on laboratory exercises,
  - — special exercises for students requiring additional help in mathematics,
  - — recommendations for "teaching paths" for the teacher and "learning paths" for the students,

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[1] For more information about how applied academics are being used in your state, see references in Appendix D.

  - — a teacher's guide that explains how to orchestrate the learning package; and
- maintain the academic rigor needed to meet some of the increased requirements for high-school graduation in science.

How Did Principles of Technology Evolve?

Principles of Technology was developed through a cooperative effort of forty-five state and provincial education agencies in association with the Agency for Instructional Technology (AIT) and the Center for Occupational Research and Development (CORD). The education agencies provided over three million dollars for the creation of *Principles of Technology* and tested the curriculum in approximately two schools per state. Following the test phase, the same education agencies took a lead role in introducing and implementing broad use of the course within their service areas. There are now forty-nine states, two provincial education agencies, and five foreign countries in the *Principles of Technology* consortium.

Principles of Technology is based on a course entitled Unified Technical Concepts (UTC) in Physics, which was developed by CORD for postsecondary technical training. The central idea in this course is that a unifying approach to physics is beneficial in the study of the basic energy systems—mechanical, fluid, electrical, and thermal. This approach is achieved by demonstrating that concepts such as force, work, rate and resistance apply and operate analogously in each of the four energy forms. The UTC course currently is being used successfully in associate-degree technician programs. UTC exhibits particular effectiveness in:

- generating student interest,
- helping students retain the technical principles,
- making course content relevant and applicable to the technician's field of work.

A more advanced version of UTC Physics, entitled *Physics for Technicians: A Systems Approach* is also available from CORD. It is used in postsecondary institutions for TPAD students who complete *Principles of Technology* in high school.

Why Should Principles of Technology Be Taught?

We all live and work in a sophisticated, rapidly changing society that is becoming increasingly dependent upon an understanding of technology. We need this understanding to make informed decisions about government policies, equipment selection for the home or office, and the operation and maintenance of complex devices and systems. But most physics courses were written for the 25 percent of high-school students who plan to pursue academic degrees at universities. Consequently, these courses do not present the physics material in a manner or at a level that can be readily mastered or used by the majority of high-school students. Nearly 80 percent of today's high-school graduates do not complete a course in physics.

To educate modern technicians we must have a curriculum that not only teaches currently employable skills, but also provides technical principles that will not become obsolete as equipment and technologies change. *Principles of Technology* is designed to be a practical science course. It does not replace the technical courses that relate to job requirements, and it is not an academically oriented science or mathematics course. It is an applied-physics course, oriented toward modern technology. *Principles of Technology* strengthens needed mathematics skills and is designed to complement existing vocational-technical curricula.

Principles of Technology is not an easy course. The scientific content and the academic rigor of the course are carefully sustained, both to provide a high quality of instruction and to meet the goal of filling high-school science requirements. Although the course is not easy, pretesting and posttesting in the pilot year indicate that most students achieve significant learning and find the course interesting and useful. *Principles of Technology* is a course that gives students technological literacy.

Where Should Principles of Technology Be Taught?

Principles of Technology is designed to be taught either in comprehensive high schools or in vocational-technical centers to tenth and eleventh grade students who plan to pursue careers as technicians and who do not necessarily plan to enroll in four-year colleges and universities in engineering or science programs. However, field tests have indicated that the course can also be used successfully for other student populations:

- vocational students in all fields (first year, or seven units, only),
- students in an academic (college-bound) track.

Some organizations are considering the use of *Principles of Technology* for retraining technical workers for high-technology jobs. The course also may be appropriate for science remediation by students entering technical programs in community and technical colleges.

How Should Principles of Technology Be Taught?

The first six or seven units can be used as a stand-alone course for students who need a one-year applied-science course and require a background in the technical fundamentals. The second year of the course (units 8-14) is most useful to students who plan to continue their study and to work as technicians in advanced-technology occupations.

Figure 1 shows the suggested sequencing of the units.

First Year	**Second Year**
Force	Momentum
Work	Waves
Rate	Energy Convertors
Resistance	Transducers
Energy	Radiation
Power	Optical Systems
Force Transformers	Time Constants

Figure 1: Sequencing of Principles of Technology Units

To Whom Should Principles of Technology Be Taught?

The target audience specified is tenth-grade nonbaccalaureate students interested in technical careers; however, the course has been found useful and appropriate for eleventh and twelfth graders, students with other vocational interests, students who are in academic pursuits, and adults who need a technical foundation for retraining.

The level of the material assumes that students have:

- one year of *Applied Mathematics*, algebra or algebra equivalent material and
- a willingness to learn how physics forms a foundation for technology.

Who Should Teach Principles of Technology?

It is important to recognize at the outset that if *Principles of Technology* is taught by certified science teachers, academic credit for lab science can be expected. Ideally, from its content and pedagogical organization, *Principles of Technology* should be taught by a vocational teacher with industrial experience and a certification in physics. Practically speaking, this type of person is atypical; in most instances, alternate selections must be made. The following types of teachers have successfully taught *Principles of Technology*:

- vocational electronics or electromechanics teachers (some drafting teachers with one or more courses in college physics),
- industrial arts teachers with one to three courses in college physics,
- physics teachers with some industrial or applications background and an interest in the *Principles of Technology* course format,
- teams of teachers with a physics teacher doing the classroom teaching and math labs and a vocational teacher doing the hands-on labs. The team-teaching approach has been found to be particularly successful when the two teachers attend each other's classes.

Whichever selection of teacher is made, it is extremely important that the teachers selected to teach *Principles of Technology* attend a *Principles of Technology* workshop. In addition, they should be given several weeks' planning time prior to the beginning of classes and some release time during the first year of instruction to get labs organized and lesson plans prepared.

Does Principles of Technology Work in the Classroom?

An extensive pilot test was an integral part of the developmental process for *Principles of Technology*. Ample evidence indicates that *Principles of Technology* works in the classroom:

- As indicated by several hundred student pretests and posttests, the pilot tests indicated statistically significant *learning gains*. These gains were consistent among grade levels and sites and among male and female students.
- *Positive teacher attitudes* also resulted from the pilot programs. Almost all teachers indicated they felt comfortable teaching *Principles of Technology*.

These positive findings do not mean that implementing *Principles of Technology* is easy. The field-test results indicated that certain conditions can enhance the successful implementation of *Principles of Technology*:

- *Teacher preparation time:* The majority of teachers reported spending, on average, more than thirty minutes preparing to teach each *Principles of Technology* class. Several reported more than an hour of preparation. This suggests that adequate preparation time should be allowed for a teacher who is teaching the course for the first time.
- *Teacher background:* Teachers with a more extensive physics background tended to be more successful in implementing the material. Although most students demonstrated a learning gain, those students whose teachers had a more extensive physics background tended to have more pronounced learning gains.
- *Class time:* Both a comparison of student test scores to teachers' reports of time spent in class and the teachers' own comments indicate that fifty to sixty minutes per session is optimum. However, there have been many variations of the fifty-minute class period with demonstrated success.
- *Lab equipment:* The problem that teachers most frequently reported was obtaining the lab equipment on time. Since the school's procurement system and the vendor delivery process likely will be time-consuming, lab equipment should be ordered well in advance of anticipated use.

The pilot test indicated that *Principles of Technology* does work in the classroom. However, like any educational innovation, *Principles of Technology* requires hard work. Clearly, a well-coordinated effort among school administrators, counselors, and teachers is the best way to ensure success.

APPLIED MATHEMATICS

What is Applied Mathematics?

Applied Mathematics is a set of thirty-six modular learning units prepared to help high-school students and adults develop and refine job-related math skills. The overall course includes materials that focus on arithmetic operations, problem-solving techniques, estimation of answers, measurement skills, graphing, algebra, geometry, data handling, probability, statistics, trigonometry, and use of computers to solve problems. Though the units include material found in traditional areas of arithmetic, geometry, algebra, and simple trigonometry, the emphasis remains on the ability to understand and apply functional mathematics to solve problems in the world of work.

What Kind of Student Needs Applied Mathematics?

This course has been prepared for learners who have an eighth-grade, prealgebra mathematics competency level and who may feel a certain anxiety about mathematics. They are written generally at an eighth-grade reading level.

The materials are deemed appropriate for high-school students in grades nine through twelve who are not necessarily baccalaureate-bound. Many of these students represent the traditionally underserved. The *Applied Mathematics* materials may also be used by adults in skill centers, Job Corps centers, or in learning centers in preemployment training, retraining, upgrade training, or apprenticeship training for technical careers.

Who Can Teach Applied Mathematics?

Applied Mathematics may be taught by teachers who understand the basic concepts of mathematics and who can communicate to students how mathematics is used in today's workplace. If the materials are taught by certified teachers of mathematics, academic credit for mathematics can be expected. Some schools may choose to use vocational teachers teamed with mathematics teachers and offer a credit in either area or offer the credit on a shared basis.

What Is the Scope and Sequence of Applied Mathematics?

Applied Mathematics is made up of thirty-six separate, modular units.[2] They are listed in figure 2. Note that the units numbered A, B, and C are optional preparatory units designed for those learners who may not have an adequate working knowledge of eighth-grade prealgebra mathematics. Each of these units encourages student use of scientific calculators while reviewing some of the main ideas that deal with numbers, fractions, decimals, and percents.

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[2] Units 23-33 will be ready for full use at the beginning of the 1991-1992 school year.

Applied Mathematics I

A. Getting to Know Your Calculator
B. Naming Numbers in Different Ways
C. Finding Answers with Your Calculator
1. Learning Problem-solving Techniques
2. Estimating Answers
3. Measuring in English and Metric Units
4. Using Graphs, Charts, and Tables
5. Dealing with Data
6. Working with Lines and Angles
7. Working with Shapes in Two Dimensions
8. Working with Shapes in Three Dimensions
9. Using Ratios and Proportions
10. Working with Scale Drawings
11. Using Signed Numbers and Vectors
12. Using Scientific Notation
13. Precision, Accuracy, and Tolerance
14. Solving Problems with Powers and Roots
15. Using Formulas to Solve Problems

Applied Mathematics II

16. Solving Problems That Involve Linear Equations
17. Graphing Data
18. Solving Problems That Involve Nonlinear Equations
19. Working with Statistics
20. Working with Probabilities
21. Using Right-triangle Relationships
22. Using Trigonometric Functions
23. Factoring
24. Patterns and Functions
25. Quadratics
26. Systems of Equations
27. Inequalities
28. Geometry in the Workplace 1
29. Geometry in the Workplace 2
30. Solving Problems with Computer Spreadsheets
31. Solving Problems with Computer Graphics
32. Quality Assurance and Process Control 1
33. Quality Assurance and Process Control 2

Figure 2: Learning Units in Applied Mathematics

Do the Materials Have "Presentation Flexibility"?

The *Applied Mathematics* learning materials may be presented as two stand-alone courses, beginning with the three optional units (if needed) and moving sequentially through Unit Fifteen for the first year course—*Applied Mathematics I*. Units Sixteen through thirty-three follow as the second year course—*Applied Mathematics II*. Or, a certain subsection of the thirty-six units may be selected and infused as appropriate mathematics support materials, for example, in vocational courses in the general areas or health occupations, business and marketing, industrial technology, home economics, or agriculture.

What Does a Typical Unit of Applied Mathematics Contain?

Each unit in the *Applied Mathematics* learning materials is an integrated learning package made up of supporting parts:

- *A video program* introduces each math unit and sets the stage for showing the relevance of mathematics in the world of work. Particular attention has been given to showing traditional minorities in nontraditional roles.
- *Student text* carefully explains the mathematics concepts for each unit.
- *Hands-on mathematics activity laboratories* help make the math concepts "come to life" and point out their usefulness. Such activities invite students to play a participatory role in the learning process. The activities are generally performed in the classroom or school environment with relatively inexpensive equipment.
- *Problem-solving exercises* in most units apply the math concepts to general and occupationally specific practical situations. The forty problems in each unit are almost always "word problems" and range in difficulty from the less difficult to the more difficult.
- *A glossary* summarizes all terms for ease of reference.

What Is a Suggested Teaching Strategy for Applied Mathematics?

Each of the thirty-six units of *Applied Mathematics* may be taught in a similar manner. The teaching strategy outlined below is meant to serve only as a *guide*. Different teachers, in different learning environments and with different student populations, will necessarily modify the pattern to suit their individual needs. The learning materials have been designed to offer the teacher sufficient flexibility to expand or contract the time devoted to each unit. For example, teachers may choose to involve students in one, two, or all of the suggested laboratory activities. In the same spirit, teachers may choose to assign five, ten, fifteen, or more of the forty problems provided in each unit.

The suggested teaching plan is to divide each unit into six activity sessions with the following components:

- "Getting Started,"
- "Learning the Skills,"
- "Applying the Skills," and
- "Looking Back."

It is important to note that we are *not* equating six sessions with six traditional class periods of forty or fifty minutes each. Rather, we suggest that the six sessions serve as a guide to the intended division of activities, and that the length of time devoted to each session—based on student backgrounds, course goals, and time available—be determined by the teacher.

Session 1 is introductory in nature. It involves overviewing the unit, watching and discussing the video, and working—as a class—the problem proposed in the video. Session 1 sets the stage for the math concepts to be learned.

Sessions 2 and 3 deal with the math concepts presented in the unit. Through the "read and do" material in the text, class activities, class discussion, and study of examples, the students learn about the basic concepts presented in the unit.

Sessions 4 and 5 focus on applying the mathematics skills in lab-oriented activities and problem-solving exercises. The use of calculators is strongly encouraged throughout these activities. In the spirit of cooperative leraning, students work together to complete the lab activities—collecting data, making calculations, and discussing their results. In the same spirit, students also work the problem-solving exercises in groups—in an informal atmosphere—helping one another and discussing approaches and solutions with each other and with the teacher, as required.

Session 6 is a wrap-up session. It is appropriate to review the unit objectives, watch the video again, and recap the ideas presented in the summary. An end-of-unit test to evaluate student progress may be administered at this time.

How Does Applied Mathematics Make Use of the Applied Approach?

Applied Mathematics follows the applications approach to learning that has been used in *Principles of Technology*. Mathematics is made relevant by showing how it is used in the world of work and by teaching problem solving through application activities. Where possible, the applications are derived from the major occupational areas: agriculture and agribusiness, business and marketing, health occupations, home economics, and industrial technology.

APPLIED BIOLOGY/CHEMISTRY

What Is Applied Biology/Chemistry?

Applied Biology/Chemistry is an integrated set of competency-based materials that can be infused into existing courses or taught as a stand-alone course. This course presents biology and chemistry in the context of work, home, society, and the environment. The *Applied Biology/Chemistry* materials include twelve instructional units containing video segments, laboratory activities, student texts, teachers guides, and resource books. The units are listed in figure 4.

Applied Biology/Chemistry was designed to achieve:

- quality science education through effective instructional materials for an underserved student population,
- participation in science courses by more students,
- a significant learning gain by course participants,
- increased completion rates by students enrolled in the two subject areas (biology and chemistry),
- increased career opportunities for these students,
- widespread usage of the course,
- enhanced work-force capability.

How Did Applied Biology/Chemistry Evolve?

Applied Biology/Chemistry was developed by a partnership that includes the state education agencies of thirty-six states, seven corporations, a national laboratory, and the Center for Occupational Research and Development. These participants have seen the success of previous applied-academic courses (*Principles of Technology, Applied Mathematics*, and *Applied Communication*) and believe in the need for this important fourth course.

Natural Resources
Water
Air and Other Gases
Plant Growth and Reproduction
Continuity of Life
Nutrition
Disease and Wellness
Life Processes
Synthetic Materials
Waste and Waste Management
Microorganisms
Community of Life

Figure 4: Learning Units for Applied Biology/Chemistry

Why Should Applied Biology/Chemistry Be Taught?

Relevant applications and hands-on learning are fundamental principles that guide the design and development of *Applied Biology/Chemistry*.

Developers believe that science taught through these principles will likely motivate students to take traditional science courses in the future.

Because the other applied-academic curriculum materials have been demonstrated to work with the students for whom they are intended, because they have been widely endorsed by both academic and vocational educators, and because an infrastructure for implementing and supporting them has developed in most states, *Applied Biology/Chemistry* can be expected to serve a large and growing audience throughout the United States.

The need for a course such as *Applied Biology/Chemistry* has been verified by conducting polls of educators and employers, by reviewing current curriculum materials in these areas, and by conferring with a conceptualization committee

Where Should Applied Biology/Chemistry Be Taught?

Applied Biology/Chemistry is designed to be taught either in comprehensive high schools or in vocational technical centers to tenth- and eleventh-grade students who plan to pursue careers as technicians in technical, health, agriculture, and home-economics fields.

How Should Applied Biology/Chemistry Be Taught?

Each of the twelve units in *Applied Biology/Chemistry* includes two to six instructional units. Each unit includes its own set of objectives and learning activities.

The units involve students in experiences related to occupations and other life situations. Students will study subject matter in terms of the central themes of science. All student activities emphasize applications, connecting the more abstract world of scientific principles to that of concrete experience. Course content is conveyed through learning activities that lead to mastery of specific objectives. The activities also allow students to learn how the central themes of science are relevant to work and other real-world situations. Learning activities may also include text readings, lectures, demonstrations, video segments, hands-on laboratories, and field experiences.

The instructional strategy of *Applied Biology/Chemistry* addresses the needs of students who should approach abstract concepts through the concrete world, to see the reason for learning a concept in its application, and to learn through hands-on experience. Therefore, hands-on learning activities are heavily emphasized, constituting at least 40 percent of the course. The learning goals of each unit of *Applied Biology/Chemistry* place particular emphasis upon higher-order cognitive processes. Students are required to demonstrate the ability to use the principles of biology and chemistry in solving problems and making decisions.

Five types of curriculum materials have been developed:

- *Student text* includes learning objectives, discussion of subject matter, and instructions for lab activities.

- *Video programs* may serve several functions, depending upon the needs of a particular unit. They may provide introductions and overviews of units, motivate students by showing applications of science concepts in real-work situations, provide role models in the form of workers doing their jobs, show demonstrations that are dangerous or expensive to set up, illustrate problem-solving activities, or provide unit summaries. Three or four videos, each five to ten minutes long, are included with each unit.
- *Teacher's guide* provides suggestions for effective use of the course materials and offers tips on setting up and managing laboratory activities and demonstrations. Solutions to lab problems, with sample data, are furnished when appropriate. Other exercises or questions introduced in the student text are fully explained.
- *Evaluation and assessment aids* include a bank of test items containing test questions for subunit pretests and posttests. End-of-unit assessments activities are also provided; these activities will focus on higher-order cognitive processes such as application, analysis, synthesis, and evaluation.
- *The implementation resource book* is designed to introduce the instructional materials to administrators, counselors, and teachers. It contains information to facilitate startup, evaluation, and maintenance of the instructional system; guidelines for teacher, counselor, and administrator workshops; and literature to inform parents, students, employers and community leaders about the course.

To Whom Should Applied Biology/Chemistry Be Taught?

The goal of this project is to provide a high-school course that provides nonbaccalaureate-bound students with a foundation of basic principles in biology and chemistry so that they can:

- make intelligent daily decisions relative to living in a technical society,
- be successful in technician training, and/or
- progress to more advanced theory-oriented courses.

Applications relevant to life and work, and hands-on learning, are fundamental principles that guide the design and development of *Applied Biology/Chemistry*. By being exposed to science in this manner, these students are more likely to take traditional science courses in the future.

While *Applied Biology/Chemistry* is designed for nonbaccalaureate-bound students, it is rigorous in its approach to science. Nonbaccalaureate-bound students need to understand and use mathematical and scientific principles in their work and daily lives. They need good science, taught in understandable, practical ways.

Applied Biology/Chemistry adheres to content standards that are acceptable to the scientific community. It provides an excellent foundation for students who discover latent interests in science and who choose to continue their study by taking traditional science courses in the future. In fact, educators in some consortium-member states indicate that the applied-academics courses already in use stimulate many students to take additional courses in mathematics and/or science that they would not otherwise have attempted.

Who Should Teach Applied Biology/Chemistry?

Science-certified teachers should teach *Applied Biology/Chemistry* if the course is taught for science credit. Home economics, agriculture, health, and technology teachers are commonly used if the course is infused into other courses or taught for vocational credit. The *Applied Biology/Chemistry* curriculum is consistent with the recommendations relative to both content and effective learning and teaching as expressed in *Project 2061: Science for All Americans* (see chapter 3 for footnote).

APPLIED COMMUNICATION

What Is Applied Communication?

Applied Communication is a comprehensive curriculum designed to help eleventh- and twelfth-grade students develop and refine communication skills for the workplace. The curriculum, made up of fifteen instructional units, consists of print and video lessons that integrate reading, writing, listening, speaking, and problem solving in a workplace context. The units are listed in figure 3.

Communicating in the Workplace
Gathering and Using Information in the Workplace
Using Problem-Solving Strategies
Starting a New Job
Communicating with Co-Workers
Participating in Groups
Following and Giving Directions
Communicating with Supervisors
Presenting Your Point of View
Communicating with Clients and Customers
Making and Responding to Requests
Communicating to Solve Interpersonal Conflicts
Evaluating Performance
Upgrading, Retraining, and Changing Jobs
Improving the Quality of Communications

Figure 3: Learning Units for Applied Communication

Each *Applied Communication* unit includes two video programs and a series of ten lessons—each forty to fifty-five minutes in duration—that incorporate demonstrations, discussions, or simulations and occupation-specific activities. All fifteen units can be used as a year-long course, or the units can be used individually in any order to supplement existing communication/language arts/English or vocational/technical courses. The course can be integrated into other courses or offered as an alternative to traditional English courses.

Applied Communication is designed to:

- build on existing English foundations;
- teach communication/language arts/English skills in an applied setting;
- help students transfer improved reading, writing, listening, speaking, problem-solving, visual, and nonverbal skills to their occupations and personal lives;
- provide occupation-specific applications for students interested in agriculture, business/marketing, health occupations, home economics, and technical/trade/industrial areas.

Who Created Applied Communication?

Applied Communication was funded and developed by a consortium of forty-eight states and provincial education agencies in association with the Agency for Instructional Technology (AIT) of Bloomington, Indiana.

The print and video materials were developed by a team of state vocational-education and English-education consultants. Once developed, the materials were reviewed by language arts and workplace specialists, consortium agencies, content specialists, teachers, and others in occupational areas served by vocational education.

Applied Communication materials were field tested with fifteen hundred students at sixty sites across Canada and the United States by teachers and classes in communication/language arts/English, agriculture, business/marketing, health occupations, home economics, and technical/trade/industrial occupations.

The Need for Applied Communication

As North America continues to experience unprecedented economic and industrial change, workers are increasingly called upon to identify problems and make crucial decisions. Today's technology-rich world rewards flexible workers, people with the skills that will help them adapt to workplace challenges.

Of these vital skills, many business leaders consider communication the most important for a student to attain. With good communication skills, workers are better able to interpret and influence their environment—to function as team members, share expertise, and take advantage of further training. But not all students are motivated by traditional communication courses.

In *Applied Communication*, communication skills are taught in a setting that models the challenges and responsibilities of the workplace. This activity-oriented approach was designed to appeal to a variety of learning styles, especially to students who are motivated by hands-on instruction. Students do not just read and talk about effective communication; they practice it—through problem-solving sessions and meetings, memos, letters, reports, charts, and graphs. Each unit features a variety of workplace-based learning activities.

Teaching Applied Communication

Applied Communication has been used successfully in a variety of instructional settings in comprehensive high schools and area vocational schools. In some schools, all fifteen units constitute a semester or year-long course. Other schools use the individual units within existing vocational, language arts, or other courses to add breadth and application of skills to the existing curriculum. Instructors who use the materials find it essential to preview each unit to determine which are most appropriate. Some instructors decide to use all ten lessons in a unit, while others select only the lessons and activities best suited to their students. All find Lesson 1 and Lesson 7 in each unit essential, since these lessons contain the video programs that focus students' attention on the skills to be learned. The activities of Lessons 8 through 10 are used most often by vocational teachers who are teamed with

English teachers, since these lessons develop and refine communication skills in agriculture, business/marketing, health occupations, home economics, and technical/trade/industrial applications. A minimum of three lessons—1, 7, and either 8, 9, or 10—is suggested for each unit.

Who Should Teach Applied Communication?

Instructors who teach *Applied Communication* should be familiar with its communication and vocational content. The curriculum may be taught by current communication/language arts/English faculty or by current vocational/technical faculty. Some schools may use teams of communication and vocational specialists to teach the course.

Whoever teaches the curriculum, it is extremely important that new *Applied Communication* teachers be given several weeks' planning time prior to the beginning of classes and be granted some release time during the first year of instruction to identify resources in the local business community and to prepare lesson plans.

Who Should Take Applied Communication?

Students enrolled in *Applied Communication* should have at least an eighth-grade reading ability. The students should be enrolled in vocational-education courses or have some work experience. The course was designed primarily for high-school students, but may be useful in postsecondary, adult-education, or retraining settings.

Can Students Receive Course Credit for Applied Communication?

Course credit is a local or state/provincial determination. Some schools teach *Applied Communication* as a year-long course of one hundred fifty class periods, each ranging forty minutes to fifty-five minutes in length. Other school districts integrate *Applied Communication*—selected units or all fifteen—into the regular communication/language arts/English curriculum. The kind and amount of credit to be granted may be determined by examining the Student Competencies Matrix for each unit, the teaching plan found in the instructor's guide, and instructional objectives for the fifteen units. Other guidance about credits may be obtained through each state or provincial department or ministry of education.

What Do Teachers and Students Say About Applied Communication?

Early pilot tests of two units as well as subsequent classroom experience have been very encouraging. Unit 7, Following and Giving Directions, was tested by seventy teachers and their classes in communication/language arts/English and agriculture, business/marketing, health occupations, home economics, and technical/trade/industrial areas. Some teachers taught all ten lessons in the unit; others used the three-lesson option. More than 80 percent of the students in this pilot program felt that Unit 7 taught them things that were "important to understand." Eighty-nine percent of the teachers said they would recommend Unit 7 to other teachers.

Unit 3, Using Problem-Solving Strategies, likewise received a favorable response from the thirty-two teachers who used the unit in their classrooms. Evaluators found that 75 percent of the teachers had never taught a unit on problem solving and 59 percent had never used a simulation with their classes before teaching Unit 3. The overwhelming majority (75 percent) of the teachers judged the video programs instructionally effective and the simulation an effective tool for teaching problem solving. The students judged the material interesting and indicated that the video programs in conjunction with the simulation provided good ways to learn to solve real problems on the job. Finally, pretest and posttest evaluations found a statistically significant learning gain for those students using the materials.

Student reactions to the introduction of *Applied Communication* as a regular course in the Salem-Keizer School District of Oregon were also very positive. At the end of the year, instructors noted that students enrolled in the course "showed an increasing interest and a desire to succeed," that participation was almost 100 percent, and that few questioned the reason for doing a unit. According to their teachers, "the students were cooperative and enthusiastic." Students at Roseburg Senior High School in Oregon were not only enthusiastic, but successful. According to their teachers, the class allowed "at-risk students to be successful in an English class."

Can Applied Communication Make a Difference?

The results of a year-long pilot test of the material conducted by the National Center for Research in Vocational Education indicate that *Applied Communication* can make a difference. Positive effects have been found in several important areas:

- Students' attitudes toward English/language arts was positive when using the applied approach. A large majority of students found the material interesting and recognized its importance.
- Students' achievement improved when using the materials. The gains were significant in the area of linking problem solving to communication.
- Students understood how English/language Arts applied to the workplace when using the materials.

Appendix C

Using Applied Academics to Improve General and Vocational Education in the High Schools[1]

Gene Bottoms

One approach to raising the academic competencies of high-school students is to change the relationship between academic and vocational education in high schools. Recent studies suggest that concepts are taught more effectively when "learning to know" and "learning to do" are linked. Allowing students to use academic materials to perform "real life" tasks or address "real life" problems increases the students' motivation to learn higher-level academic concepts in high school.

Vocational education can provide the natural setting in which to create new connections between academic concepts and the practical uses of those concepts. The full potential of the vocational classroom has yet to be developed. One reason is that some educators and policymakers have thought of vocational education as strictly procedural, or "hands on" learning, rather than a setting in which reading, writing, mathematics, and science knowledge can be increased by being applied to the problems and tasks of a vocational field of study. As a result, an important resource and a major educational investment are being underutilized.

Research supports the idea that changing the relationship between vocational and academic education can improve student achievement. However, evidence also suggests that doing this will require fundamental changes in the way high schools operate. Because attitudes and behaviors tend to be firmly entrenched, the amount of time required to create new relationships between academic and vocational education should not be underestimated.

THE NEED FOR A REVISED VOCATIONAL CURRICULUM

Recent regional and national studies show that well-designed vocational courses can raise academic achievement levels significantly. For example, students achieve significantly more academically in vocational classes where they perceive that the teacher often stresses the application of academic competencies (see figure 1).

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[1] Excerpted and adapted from Gene Bottoms and Alice Presson, "Improving General and Vocational Education in the High Schools" (Report prepared for SREB Consortium, 1989).

The impact is greatest when vocational courses are deliberately aimed at reinforcing higher-level academic competencies such as problem solving, comprehension, science, and mathematics. However, while some states have successfully integrated academic content into vocational courses, too many vocational courses in high school are still "pitched" at an instructional level that provides little or no reinforcement for development of higher-level academic competencies.

	Reading		Mathematics		Science	
	Percent of Students	Score	Percent of Students	Score	Percent of Students	Score
Often stressed	46.6%	54.8	56.2%	296.1	26.6%	270.9
Never stressed/ could not recall being stressed	23.8%	51.7	17.1%	287.1	42.2%	246.6

Figure 1: Student Scores as Related to Teacher Emphasis on Reading, Mathematics, and Science Skills[2]

This situation persists because neither local nor state school-board policies have clearly stated that advancing students' academic competencies is a primary purpose of vocational education. A recent survey of over one thousand educators (vocational and nonvocational) in fourteen southern states revealed no consensus about the primary purpose of vocational education.

In the same survey, three out of four vocational teachers reported that they are inadequately prepared to reinforce academic competencies, yet 60 percent of them say it is extremely important for them to stress mathematics and reading. Consequently, it is not surprising that successful efforts to strengthen vocational programs have involved intensive staff and curriculum development.

THE NEED FOR A REVISED GENERAL ACADEMIC CURRICULUM

While developing vocational courses that reinforce academic skills can result in some achievement gains, these changes are not enough. Reaching the levels of achievement needed requires revising the overall general curriculum.

Vocational and general students take about three fewer "academic" courses than those in college-preparatory programs. This fact only hints at a more serious problem. Studies and reports suggest that a significant proportion of students in vocational and general studies receive little counseling on the courses they should be taking (see figure 2). Too often, these students are allowed to "graze over the field" of less-demanding academic courses (see figure 3) and an odd assortment of very basic, low-level, and frequently unrelated vocational courses.

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[2] Results from National Assessment of Education Progress Science test administered in 1988 to students at pilot sites who had completed four or more courses in a vocational major. Percentages will not add up to 100 percent because other answer choices were available.

Encouraged choice of math or science courses:	
No one	51%
Counselor	21%
Parents	16%
Vocational teachers	2%
Non-vocational teachers	10%
Assistance in planning four-year programs of study:	
Parents met with school persons	15%
Counselor	48%
No one	52%

Figure 2: Course Selection Assistance Received by Students Completing Vocational Programs[3]

Mathematics	2.7	Total Math Credits
	1.6	Credits: Algebra I or higher
	61%	Completed Algebra I
	33%	Completed Geometry
Science	2.2	Total Science Credits
	1.0	Credit: General, Physical, or Earth Science
	0.9	Credits: Biological Science
	16%	Completed Chemistry
	1%	Completed Physics

Figure 3: Average Amount and Type of Mathematics and Science Credits[4]

The problem is twofold. Unlike the standards established for graduates of college-preparatory programs, state and local policies have not required vocational graduates to complete a prescribed sequence of mathematics and science courses, even though they need such courses in order to be educated workers.

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[3] Results from National Assessment of Education Progress Science test administered in 1988 to students at pilot sites who had completed four or more courses in a vocational major.

[4] Based on analysis of transcripts of courses taken by 1988 SREB pilot-site seniors who had completed four or more credits in a vocational major.

Furthermore, state and local policies have allowed graduates from the general curriculum to complete high school without pursuing an in-depth study in either an academic or vocational program. Thus, many high-school graduates are prepared neither for employment nor for postsecondary education. Since 1980, a higher percentage of these high-school graduates have entered postsecondary vocational education, but many of these failed to earn degrees or certificates.

Recent studies suggest that secondary courses labeled "general" or "basic" result in little or no gain in achievement in mathematics and science. Studies also show that courses designed to teach essential academic content through an applied process can raise students' expectations, motivation, and achievement, while preparing students better for employment and postsecondary education.

THE NEED FOR HIGHER EXPECTATIONS

In many high schools, too little is expected of general and vocational students by administrators, counselors, and teachers. Schools vary greatly in the level of academic courses they require vocational students to take. Out of thirty-four high schools, for example, the number of vocational graduates completing Algebra I ranged from 34 percent in one school to 95 percent at another. The student bodies from these two schools had similar socioeconomic backgrounds.

Schools also differ in what they expect of vocational students in their classes. For example, the percent of vocational graduates reporting no homework outside of school ranged from 4 percent at one school to 55 percent at another. In fact, when asked, a majority of students pursuing vocational studies say too little is expected of them in both their academic and vocational courses.

This can be changed. Throughout the south, many schools are adopting well-developed "applied academic" courses (Principles of Technology, Applied Mathematics, etc.) and revising instructional strategies and materials used in existing courses to establish higher standards and expectations for general and vocational students. These schools have discovered that many more high-school students can master essential content from the college-preparatory curriculum if they are encouraged and allowed to enroll in such courses, if special efforts are made to teach abstract concepts through an applied and functional approach, if they are given extra assistance and encouragement as needed, and, most important, if teachers expect students to succeed.

THE NEED FOR A COHERENT PROGRAM OF VOCATIONAL STUDY

Improving the general and vocational curriculum involves more than vocational teachers' emphasizing the academic content of traditional vocational courses and academic teachers' finding more ways to teach concepts through an applied process. Improvement also demands more than replacing watered-down, "general" academic courses with more rigorous "applied" courses emphasize higher-level academic content. A new approach involves a shift from offering a fragmented collection of unconnected courses to developing a structured, coherent, and challenging program of study that combines academic and vocational elements and is designed with a double purpose—preparing students both for employment and for further education after high school.

This means that many high-school counselors will have to discontinue their current practice of guiding general and vocational students toward a high-school program of study that represents only the minimum of what is required to graduate from high school. For example, a transcript analysis of nearly three thousand high school vocational completers revealed that only 12 percent of the students met the criterion of having completed three mathematics and science credits, with two credits in each field being equivalent to content in college-prep courses (see figure 4). The percent of students meeting this criteria at individual schools ranged from 0 percent at some sites to over 65 percent at one site. Only 16 percent of all the students completed three science credits with at least two credits in college-prep-level lab science courses, while 29 percent completed three mathematics courses with at least two credits earned in Algebra I or higher-level courses.

Blending academic and vocational instruction is not a "quick fix" for the problems of American education, but it has the potential for "toning up" the high-school education of general and vocational students. Closing the gap between academic and vocational instruction will require much planning, considerable staff and curriculum development, and the cooperation and commitment of school boards, principals, counselors, teachers, and vocational administrators. It also will mean working in more effective ways with the business and industrial community so that parents, teachers, and students understand that competencies in higher-level mathematics, science, and communications are essential for employment advancement. Such efforts can result in many benefits. A planned program of vocational and academic study has the potential of:

- providing a structured and purposeful high-school experience for those students who traditionally have been allowed to select at random an unconnected collection of low-level academic and vocational courses;
- raising academic and technical achievement expectations for students as teachers come to see them as capable of greater achievement;
- motivating students to pursue more rigorous academic courses by helping them to see the connection between academic and vocational competencies; and

- creating a team of vocational and academic teachers who provide the encouragement, support, and extra help needed by students.

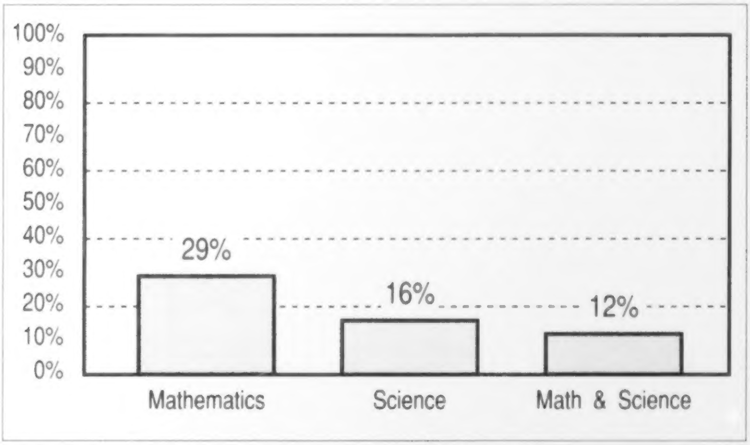

Figure 4: Vocational Completers Who Fulfilled SREB Consortium Course Requirements[5]

THE NEED FOR VOCATIONAL AND ACADEMIC TEACHERS TO WORK TOGETHER

For the new approach to succeed, academic and vocational educators must be equal shareholders. This assertion is made for two reasons.

1. *The barrier between academic and vocational education is an artificial one*, attributable to an educational tradition that places more value on learning for learning's sake than on learning for a purpose. Both academic and vocational educators need to heighten their recognition of the complementary nature of their work.

2. *Teachers need each other in order to understand and present material thoroughly*. All secondary school teachers are specialists—an electronics teacher no less than a biology teacher. Each teacher should know one content field particularly well, along with the pedagogical strategies that work best in transferring that knowledge to students. Thus, mathematics is best taught by trained mathematics teachers and carpentry by experienced journeymen. By working together, however, teachers will see where their areas of expertise intersect and can support one other. The mathematics teacher can ensure that

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[5] Based on analysis of transcripts of courses taken by 1988 SREB pilot-site seniors who had completed four or more credits in a vocational major.

problems to be solved reflect practical, applied situations; conversely, the carpentry teacher can emphasize the many ways that computation or mathematical principles come into play in that trade. Students (and particularly reluctant students) reap the benefits by realizing that, indeed, there is a point to academic knowledge. We cannot expect students to see the relationship between academic disciplines and problems in a vocational context unless their teachers do.

Successful implementation of a program of vocational and academic study will place new demands on teachers' time. The most promising approaches are those in which the vocational and academic teachers work together to develop new or adapt available curricula, plan courses, and prepare materials for instruction. These activities take time not currently available during the school year. Bringing these two groups of teachers together to develop and implement better alignment of the academic and vocational curriculum, whether they are in the same high school or in an area vocational center and several feeder high schools, will require that schools reduce course loads, provide summer planning activities, and allow for planning and organizational periods free from the press of daily teaching.

THE NEED TO UPGRADE HIGH-SCHOOL GRADUATION REQUIREMENTS

Raising the quality of all courses and improving the relationship between academic and vocational education will require that high-school graduation requirements be tightened to ensure that students in the general and vocational curricula complete courses containing higher-level academic elements and incorporate advanced study in either a vocational or an academic field. High-school seniors who have pursued a general-academic course of study and who have come later to realize the need for higher-level academics express disappointment that the school failed to require them to take higher-level mathematics and science courses. A change in graduation standards is essential if future graduates are to have the competencies needed for continued learning in either a work or an educational setting.

The failure of local school districts to change what is expected of general and vocational students is due, in part, to the failure of postsecondary leaders to communicate clearly the prerequisites for success. The message too often sent is that any high-school graduate will be accepted regardless of what he or she hasn't taken in high schools.

Recent interviews with over three hundred high-school seniors enrolled in general and vocational courses revealed that half planned to attend a community college but were unaware that the academic courses they had taken were inappropriate preparation for postsecondary education. They did not realize that they would spend the better portion of their first year taking developmental courses to make up for having taken the dessert academic courses in high schools.

It should surprise no one, therefore, that only one out of five persons entering a community college completes either an associate-degree or certificate program. There are few notable joint efforts by secondary and postsecondary schools to inform students, teachers, and parents about the type of high-school experience needed for success in further education or employment.

TECH PREP/ASSOCIATE DEGREE: A PROMISING ANSWER

The 2+2 concept, now called Tech Prep/Associate Degree, offers an answer to all the above-stated needs. TPAD holds the promise for upgrading America's front-line workers. Improving the productive capacity of entry-level workers is accomplished by providing youth with access to a more challenging and sequential program of academic and vocational study through purposeful efforts to link secondary schools and two-year postsecondary institutions.

With a few notable exceptions, however, TPAD programs to date have been driven more by the needs of postsecondary institutions to recruit secondary youth than by the need to design an improved secondary and postsecondary education experience. Too often the TPAD program is nothing more than an articulation agreement between secondary and postsecondary educators regarding advance placement for secondary vocational completers in postsecondary vocational programs.

Some excellent TPAD programs do exist, involving one or two vocational fields such as electronics and health. But these efforts do not involve reforming either secondary or postsecondary institutions. Rather, they represent tinkering with one or two vocational programs. The numbers of students participating in such programs remains so small as to be insignificant. Where the TPAD concept has been used as a means of restructuring the high-school curriculum, the result has been to add another track called "tech prep" while leaving in place the existing general, vocational, and college-prep tracks.

It was against this backdrop of concerns that thirteen states (now fifteen) joined with the Southern Regional Education Board in 1987 to create a multistate consortium aimed at converting the spirit of the TPAD concepts into a set of strategies for restructuring the general and vocational curriculum for grades nine through twelve. The intent is to raise significantly the mathematics, science, and communications competencies for those young people who aren't enrolled in the college-prep curriculum by providing them access to a more challenging program of study. The intent is to eliminate the general track as it currently exists and replace it with a more purposeful and challenging program of study aimed a preparing these youth for a double purpose: continued learning in either a work or postsecondary education setting.

The remainder of this chapter is a description of how these fifteen states are trying to advance students' mathematics, science and communications skills by improving general and vocational education in the high schools. The first section describes the general strategy for using the TPAD concept to improve the high schools. The second section contains specific recommendations for improving general and vocational education in the high school.

RECOMMENDATIONS OF THE SREB CONSORTIUM FOR IMPROVING GENERAL AND VOCATIONAL EDUCATION IN HIGH SCHOOLS

Significant improvements in the mathematics, science, and communications competencies of high-school graduates from the general and vocational curriculum will require that these two curriculum areas are linked and fundamentally changed so as to produce a coherent and challenging high-school program of study. The following recommendations are offered as means for achieving this.

Recommendation #1: Redefine Vocational Education

School-board policies should clearly define the purpose of vocational education as "education," a much broader concept than "training." School boards should adopt a statement of purpose which stresses that the aim of secondary vocational education is to prepare youth for the dual purposes of employment and successful continued learning both on the job and in postsecondary education. This means raising the levels of academic achievement expected for all students and using vocational education as a means of helping students improve their competencies in the areas of communications, mathematics, science, and technology. It also means shifting secondary vocational education away from a "training strategy" that focuses only on narrow-based entry-jobs to an "educational strategy" aimed at developing individuals with the capacity to think, learn, create, and succeed in a changing work place. The emphasis is on an instructional approach designed to increase students' use of academic competencies to grasp work-related content, procedures, and problems in broad occupational or technical fields.

Recommendation #2: Upgrade the Academic Content of Vocational Courses

Existing vocational courses need to be revised and new ones developed by significantly expanding the emphasis on advancing the communications, mathematics, and science competencies of students. This change in emphasis will enable vocational programs better to serve students with different educational and work goals. Incorporating related higher-level academic content into vocational courses will require investments in curriculum development and instructional materials. Quality materials for teaching academic competencies through vocational courses are not currently available on the commercial market. Without such materials, changes in vocational instruction will be slow in coming because most vocational teachers have neither the time nor expertise necessary to develop and prepare quality materials that utilize the context, problems, materials, and procedures of a vocational field for advancing reading, writing, mathematics, and science achievement. Developing this kind of curriculum will require vocational and academic educators to work with persons skilled in preparing instructional materials for students.

Recommendation #3: Provide Applied Academics

Technological advances in the workplace demand that new workers have a literacy level in communications, mathematics, and science equivalent to the essential content of the traditional college-prep curriculum. To provide all students with this needed fundamental core of academic competencies will require creating new academic courses that teach higher-level content through a functional, applied, or occupationally related approach.

Another strategy involves revising existing academic courses so that emphasis shifts to "concrete, hands-on" learning experiences related to students' vocational interests. It is important that the content of new or revised academic courses be equivalent to essential core elements taught in the language arts, mathematics, and science courses in the college-prep curriculum.

A parallel action would be to eliminate from the secondary-school curriculum those low-level academic courses labeled "general" or "basic" that produce little or no gain in students' academic achievement. They should be replaced by a revised sequence of courses as described below.

1. *Mathematics.* It appears that too many vocational and general students spend most of their time in mathematics courses watching the teacher work problems on the chalkboard and then completing pencil-and-paper drills to practice in a rote manner what they have just seen the teacher do. We need to move away from current instructional methods that focus on the repetition of rote mechanical skills. More innovative forms of instruction are needed that link the application of mathematical concepts and skills to solving real-world problems found in a broad range of jobs. "Hands-on" instructional activities that promote the use of calculators and computers to perform the mechanical functions of mathematics, are important!

2. *Science.* What has traditionally been taught in the science courses taken by general and vocational students may not be sufficient or appropriate for students pursuing vocational studies. The primary technique for teaching science to general and vocational students continues to be textbook and lecture-discussion combined with workbook exercises. Little attention appears to have been given to the content and sequence of science instruction in the various vocational concentrations or to strategies for improving science instruction in both academic and vocational courses. As a result, many young people leave school without the scientific skills and knowledge necessary to succeed in an increasingly technological workplace and society.

3. *Reading.* Attention to higher-level reading skills should be addressed by all secondary teachers. Schools that are most successful in raising the reading skills of vocational students appear to be those that have moved away from "packaged" reading programs that concentrate on isolated skills to strategies that provide students with a wide range of challenging materials directly related to their vocational and academic studies. The more successful efforts no longer allow watered-down textbooks; rather, comprehensive strategies are developed that will ultimately lead to students' mastery of more complicated materials. Vocational and academic teachers need extensive staff development programs on "reading for learning" in academic and technical fields.

Recommendation #4: Develop New Sequences of Vocational Study

State and local school boards should redefine a vocational program as one containing a coherent sequence of academic and vocational courses aimed at preparing students for employment and postsecondary education. In addition, these boards will need to ensure that a "vocational completer" demonstrates a satisfactory level of both academic and technical achievement.

Local committees composed of vocational and academic teachers, employers, and postsecondary education representatives would be responsible for recommending a coherent sequence of vocational and academic courses in grades nine through twelve for both vocational majors (such as practical nursing, horticulture, or secretarial work) and broad vocational fields (such as business, manufacturing, mechanical trades, construction, hospitality, agriculture.) These sequences should be designed to prepare students to enter related employment and provide them with the knowledge and skills necessary to continue to learn in a work and educational setting.

The program of study developed by the committee should include the following requirements.

- Students should complete at least three credits each in mathematics and science, with at least two credits in each area coming from courses with content comparable to that in the college-preparatory curriculum. All required science courses should emphasize laboratory experiences. Where possible, the proposed mathematics and science courses should be relevant and related to students' vocational majors.
- Students should complete least four credits in a vocational concentration and specify the proposed sequence of specialty courses.
- Students should complete at least two credits in related vocational studies. These courses should be drawn from a list of courses designed to introduce students to generic technical competencies and to a broad range of occupational and technical fields such as basic electricity/electronics, computers, technical graphics/drafting, accounting, technical/business writing, manufacturing, mechanics, material science, agriculture, and food science.

- Students should acquire at least one-half credit in a computer course that teaches keyboarding and basic computer application.

Recommendation #5: Upgrade Graduation Requirements

School boards should revise the requirements for awarding high-school diplomas so that they reflect more accurately the current and anticipated needs of students and the nation's economy.

The high-school graduation requirements found in figure 5 are recommended to ensure that all students pursue either a more challenging and coherent program of academic and vocational studies or in-depth study in an academic field.

Recommendation #6: Do More to Help Underachievers Succeed

Underachieving students need access to rewarding and demanding vocational programs and academic courses and to the continued extra assistance they need to succeed. Special initiatives will be needed to:

- discontinue low-level vocational courses that seek to train students for entry-level jobs with no clear path for career advancement;
- ensure that all students, especially underachieving and poorly motivated ones, have access to a comprehensive range of challenging vocational programs in fields with good opportunities for future employment and education;
- revise all vocational-education curricula so that the content is congruent with labor-market needs;
- provide underachieving students on a continuing basis with the extra help they need to master required academic and technical competencies; and
- establish teams of teachers who are committed to coordinating academic and vocational instruction so that underachieving students will be successful in advancing their academic and technical competencies. Underachieving students need to know that the school and their teachers believe they can succeed and will assist them in doing so.

Recommendation #7: Link Secondary and Postsecondary Education and Training

To increase the percentage of graduates who pursue study beyond high school, all approved secondary vocational and academic programs of study should be part of either a formal articulation agreement or a "4+2" program plan with either a postsecondary institution or other recognized training program.

The challenge here is to encourage representatives from high schools, postsecondary institutions, and business and industry to work together in planning a high-school curriculum that is connected with a planned advanced program of study in either an institutional setting or the workplace. The planned curriculum would include both academic and technical courses.

Recommendation #8: Provide Assistance in Course Selection and Planning

Beginning no later than grade eight, students should receive educational, career, interest, and attitude assessment information to assist them in planning and pursuing a meaningful four-year educational plan. This does not mean students should be forced to follow it blindly or be unable to change the path. However, if change is indicated, students should be given special attention. At present, too many students in the general track are left on their own to select from a course "cafeteria" of equally poor fare. Students and their parents or guardians should meet with a guidance counselor annually to review, update, or alter the four-year plan as students refine their interests and goals. A planned assessment and counseling program can build students' confidence in their unique abilities and can help affirm their pursuit of a more rigorous program of study.

Information collected by the SREB State Vocational Education Consortium reveals the following inadequacies in the present system of assessment and counseling for students in the general and vocational curriculum:

- About half the students indicated they had not received help from their counselors in developing a four-year plan, and only 15 percent reported that they and their parents had met together with school personnel to develop such a plan.
- Most students indicated that they had not been encouraged to take higher-level academic courses to complement their vocational intent.
- Only a few schools have developed plans to assist students in pursuing a coherent and challenging program of vocational and academic study.
- Only 2 percent of the students credit their vocational teachers with providing assistance in the selection of mathematics and science courses.

At the same time, those graduating seniors who *had* received special aptitude and interest assessment and counseling often referred to this as a significant event in establishing their confidence and in affirming their commitment to pursue a more rigorous program of vocational and academic study. An effective guidance program is essential in improving general and vocational students' commitment to higher achievement.

Recommendation #9: Provide Staff Development

An investment in staff development will be required to:

- assist vocational teachers in upgrading their academic knowledge and their ability to use teaching methods that blend academic and vocational studies;

Subject Area	Number of Units
English	4
Mathematics (meet specified requirements)	3
Laboratory Science (meet specified requirements)	3
Social Studies U.S. History, U.S. Government and Economics, and World History and Geography	3
Vocational or Academic Major (meet one of four options)	6
Health and Physical Education	1
Fine Arts or Practical Arts	1
Electives	3
Total Units	24

Minimum mathematics requirements for students would include two mathematics credits at the level of Algebra I and above, or two mathematics credits in courses specifically designed to teach similar content through an applied or functional process.

Minimum science requirements for students would include two lab science credits at the Biology I, Chemistry I, or Physics I level or above, or science courses designed to teach similar content through an applied or functional process.

Minimum requirements for a vocational academic major could be met by students completing a planned program of study with one of the following four options:

1. Complete requirements for a college preparatory curriculum or special recognition diploma or certificate;
2. Complete an approved program of vocational and academic study that consists of at least 4 credits in a vocational major and two related vocational credits from the broad fields of technology, such as computers, electricity/electronics, mechanics, technical graphics, lasers, communications, agriculture and food, biotechnology, medical technology, manufacturing, transportation, etc.
3. Complete an approved program of vocational and academic study which consists of at least three credits in each of two different vocational majors;
4. Complete two additional higher level mathematics and science credits and four credits of advanced courses from the following fields: English, social studies, foreign language, fine arts, or vocational education major. All academic credits for the fourth option, except for fine arts and vocational education, to be earned in courses either from the college preparatory curriculum or from courses with similar content or rigor.

Each of these options requires students to complete, either before or during high school, an equivalent one-half unit credit in a computer course that emphasizes keyboarding and computer use skills.

Figure 5: Recommended High-School Graduation Requirements

- assist academic teachers in devising learning experiences that help students see the connection between communications, mathematics, and science skills and jobs; and
- assist counselors and administrators in rethinking strategies for raising the rigor and status of a combined vocational and academic program of study to a level comparable to that of the college-prep program.

In addition, all secondary teachers—academic and vocational—need help in devising ways to strengthen students' reading and writing skills for learning in content fields.

Recommendation #10: Establish Performance Indicators

To track progress on increasing the basic competencies of general and vocational students, indicators should be established for keeping score in four main areas—academic achievement, vocational attainment and technical achievement, employment outcomes, and postsecondary continuation and achievement.

Possible indicators of improved academic achievement would include:

- raising the basic reading, mathematics, and science competencies of students who complete secondary vocational and general programs of study to the 50th national percentile or higher, as measured by programs such as the National Assessment of Educational Progress or by significant gains in the academic achievement of students in relation to prior achievement; and
- increasing annually the percentage of students who have taken two or more college-prep mathematics courses, two or more college-prep science courses, or courses specifically designed to teach similar content in an applied context.

Possible indicators for improving vocational attainment and technical achievement would include:

- establishing targets for the percentage of students who complete vocational programs and are successfully placed in related a job, or the military, or pursue further education (for example, a state target of 80 percent or more may be a desirable goal); and
- establishing achievement cut-off scores on technical competencies examined for each vocational field and increasing annually the percentage of high-school graduates meeting the minimum scores;

Possible indicators for improved employment outcomes would include:

- tracking employment experiences, including earnings and career advancement of vocational course takers, over time;
- checking on skill levels of jobs obtained; and
- determining student and employer satisfaction.

Possible indicators for improved postsecondary continuation would include:

- *increasing to 50 percent the number of students who complete planned* vocational and academic programs and continue their education within one year after high-school graduation;
- increasing to 50 percent or above (the national average is now about 30 percent) the percentage of students from the general and vocational curriculum who enter and complete postsecondary educational programs within four years after high-school graduation;
- increasing the percentage of high-school graduates with a "match" between their high-school and post-high-school vocational credits.

Establishing performance indicators will serve three main purposes. First, publicly announcing the indicators will ensure that both educators and the general public are aware of the goals and directions for the improvement of general and vocational education. Second, the publication and distribution of information about the performance of high-school graduates will challenge schools to improve the performance of their own students. Third, reliable performance information can fuel the public's demand for serious program improvement and increase public willingness to provide the resources to accomplish that improvement.

Finding ways to measure the gains in students' academic achievement and technical competencies is not easy or cost-free. However, developing, using, and reporting results should be major elements in a plan for positive change.

Appendix D

TPAD Resources

FOR FURTHER READING

About Academic Reform

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For further information about materials or procedures listed in this book, please contact the following people and/or organizations.

Associate Degree Programs

American Association of Community and Junior Colleges
Suite 410, One Dupont Circle N.W.
Washington, DC 20036

Applied Academics Courses

For information about *Principles of Technology, Applied Mathematics,* and *Applied Biology/Chemistry,* contact:

The Center for Occupational Research and Development
601 Lake Air Drive
Waco, TX 76710
800-231-3015

For information about *Applied Communication,* contact:

The Agency for Instructional Technology
Box A
Bloomington, IN 47402
800-457-4509.

Video Promotion

For information about producing TPAD videos (see chapter 8), contact:

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Computerized Database

For information about the The Occupational Articulation (OA) Database software, contact:

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Oregon Department of Education
700 Pringle Parkway, SE
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Curriculum Samples

For curriculum samples and examples of working TPAD programs, contact:

National Center for Research in Vocational Education (NCRVE),
Materials Distribution Service
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46 Horrabin Hall
Macomb, IL 61455
800-637-7652

Or contact your regional director of The National Network for Curriculum Coordination in Vocational and Technical Education (NNCCVTE):

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tackle them? How do different people (teachers, counselors, employers, parents, students) feel about TPAD? What should be in a TPAD curriculum? What does it cost? Where is it working, and why? How can you get TPAD started in your community?

If you are involved in TPAD, or just interested in finding out more about it, this is must reading for you. This is the definitive book on the subject, combining the authority of the man who coined the term Tech Prep with the combined wisdom of the outstanding TPAD exponents in the country.

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